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THE RADICAL OPERATION FOR CANCER OF THE PYLORIC END OF THE STOMACH[1]

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PYLORECTOMY and partial gastrectomy have been accepted operations for more than a quarter of a century. Pean (1) in 1879 made the first pylorectomy; the operation was next performed by Rydygier (2), whose original contribution was both attractive and sound. To the master surgeon Billroth (3), who did the first successful operation in 1881, must be given the credit for not only developing the technique but for a thorough elucidation of the principles which guide us in its performance.

Cunéo (4), by a brilliant study of the lymphatics of the stomach, added greatly to our knowledge of the spread of malignant disease of this organ; and, based on his work, Mikulicz and Hartmann were able to point out the necessity for the extirpation of the glands on the lesser and greater curvatures respectively. In spite of the great importance of the contributions of these and other men, in spite of the fact that the operation has been one of diminishing mortality and that undoubted cures are to be found in literature, the operation has not been popular.

Cancer of the stomach is the most frequent form of cancer in the human body. In at least 75 per cent of gastric cancers the pyloric half of the stomach, which is the readily removable portion, is involved. The opportunities, therefore, for the operative treatment of gastric cancer are many, but the surgeons performing the operation are few and the results meager.

Perhaps the most important reason for this apathetic attitude of the profession in regard to cancer of the stomach has been our inability to make a diagnosis sufficiently early for the performance of a radical operation with a reasonable operative mortality and a fair prospect of cure. At present, however, largely through radiography, the clinical diagnosis of cancer of the stomach can be made early in a large percentage of cases. Exploratory incisions, which up to within the past year were our chief reliance, though carrying with them the patient's dread of an unnecessary operation, are fortunately no longer required in anything like the percentage of cases in which they were formerly necessary. The history of the patient, the radiographic and physical findings, and the use of the stomach tube to-day give a reasonable prospect of a correct early diagnosis.

The laboratory tests, so long depended on and which had proved so fallacious a guide, have been justly relegated to a minor position. These tests should not be abandoned, however. They are of value in differentiation, and since they may now be checked up by other means, this value should increase as we learn correctly to interpret their results.

Another reason for the reluctance with which the radical operation for cancer of the

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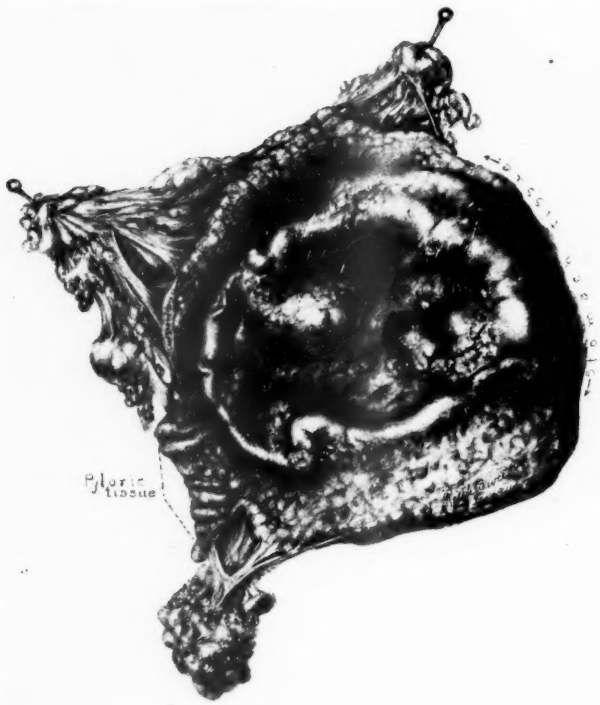

Fig. 1. Gross specimen. Three-fifths of stomach removed for large fungating carcinoma.

stomach has been adopted by the profession is the immediate mortality. These patients are usually poor risks; the operation is one which requires a high grade of skill and technical knowledge, and the margin between recovery and death is at best a narrow one. The patient who does not do well usually dies because the conditions which interfere with his recovery are in themselves most serious and the resistant powers low.

Little comment is necessary concerning the main features of the operation of partial gastrectomy. They are well known and are not in controversy. The lymphatic glands lying in four groups with the four blood-vessels are quite easily extirpated. The high ligation of the four vessels renders the field of operation dry and bloodless—an important consideration, since loss of blood in debilitated patients is the most potent cause of surgical shock. The operation can be done in the average case within an hour.

There have recently appeared an encouraging number of contributions to this subject, especially relating to the technique and containing suggestions for shortening the length of time of the operation, which has been at least one of the factors in the death rate. Of these contributions, Crile's (5) and Lilienthal's (6), advocating the two-stage operation, have been among the more important. They have rightly called attention to the fact that in debilitated patients gastro-enterostomy, which can be done quickly, improves the patient's nutrition and general condition; and a resection can be made at a later time without so serious a risk.

In our clinic we have in the last fifteen

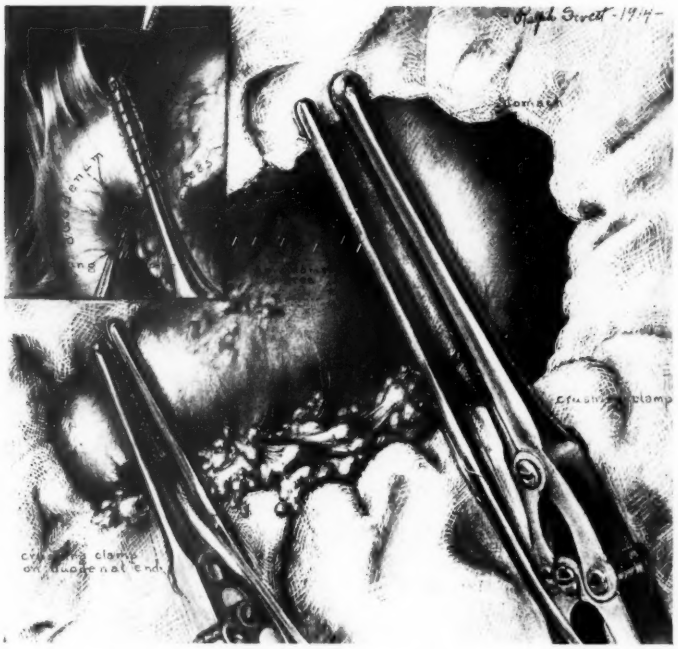

Fig. 2. Blood-vessels tied, glands separated, crushing clamps in place and also clamps to prevent leakage from part to be removed. Upper left drawing shows stump of duodenum in crushing clamp with suture placed for closing.

years made a number of the two-stage operations for cancer of the stomach, and of these not one patient died as a result of the resection. Standing alone, this would seem to be a strong if not an absolute indication for the two-stage operation. But an examination of the facts concerning these cases leaves the indications less clear since they were in a sense selected from a number of patients on whom we could have done a primary resection and who were subjected to a gastro-enterostomy with the intention of following this procedure by a resection, but who for one reason or another never came to the radical operation. First, some of those who were in a most serious condition died following the gastro-enterostomy. They would, of course, have died if a primary resection had been made instead of a gastro-enterostomy, but the resection received the benefit so far as mortality statistics are concerned. Second, some of the patients, especially those with large ulcerating cancerous masses, did not sufficiently improve after gastro-enterostomy to enable them to submit to a second operation, again bettering the statistics of resection by the elimination. Third, an occasional patient would improve so greatly following gastro-enterostomy that a radical operation would be refused until too late. Figure 1 shows a specimen from a considerable group of patients on whom we have done a primary partial gastrectomy, but who, for reasons already stated, would probably not have come to a secondary radical operation if a gastro-enterostomy had been done primarily instead of the resection.

Another fact of great importance was the occasional delay before the second operation, as a result of various causes following the gastro-enterostomy — a delay which resulted in the vascularization of the adhesions which so often formed, following the first operation and which in this process became infected

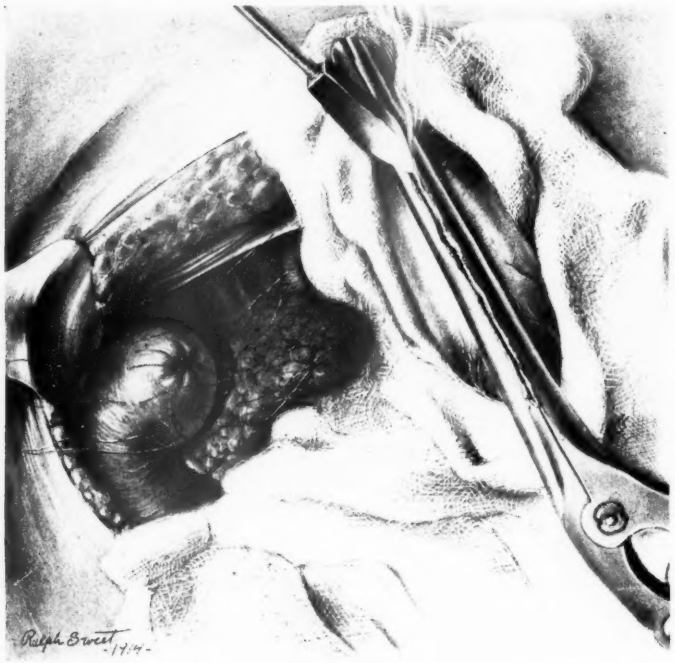

Fig. 3. Crushing clamp on the stomach. Cautery used to sterilize and prevent carcinomatous implantation. Stump of duodenum closed. Sutures placed to turn the duodenal stump into the denuded head of the pancreas.

with carcinomatous cells. The question of the implantation of cancerous cells during operation is a most important one. I have related elsewhere (7) some cases in our early experience where cells were loosened up from gastric carcinoma and implanted upon the margins of the portion of stomach which remain following resection. For this reason we have since cauterized the cut end of the stomach and duodenum with the actual cautery to lessen this liability. In several of our cases the abdominal wound was so infected. Grafting in carcinoma of the stomach is exceedingly common, especially grafting to the peritoneum; and the necessary handling of the growth, irritation of the peritoneum, and the injury inflicted by the performance of the gastroenterostomy itself are all matters of importance in this connection.

I am under the impression—after, it is true, a somewhat superficial examination of the subject—that the percentage of five-year cures in the two-stage group has not been as high in our experience as in the one-stage operation. It would seem that the two-stage operation is one which should not be generally adopted, but rather one for the occasional case in which the general condition of the patient rather than the local condition of the tumor is the indication for this particular method. Under such circumstances we employ the two-stage operation and believe that an occasional case is carried to a successful termination who might have been lost following the one-stage operation.

If the two-stage operation is decided upon, it is necessary to plan the gastro-enterostomy opening so that it will be in a situation which will not cramp or hamper the resection.

The mortality depends more upon the cases which will be accepted for operation than upon any other one factor. We have had

Fig. 4. Upper jejunum six to twelve inches from origin brought through an opening which has been made in the transverse mesocolon and united by outer row of seromuscular silk sutures to the posterior wall of the stomach.

mortalities in some years following partial gastrectomies as low as 6 per cent; in other years, with an increasing experience and improved technique, a mortality of twice that or even more, due to the class of cases which we accepted for operation and which would previously have been subjected, if operated on at all, to a palliative gastro-enterostomy.

Should patients with advanced cancer of the stomach be subjected to radical operation? In view of the fact that some of these patients, especially those with large fungating growths, have lived beyond the five-year limit, we are compelled to answer the question in the affirmative. We should further consider the fact that patients subjected to the removal of the visible growth in the stomach, even if all the glands cannot be removed, will get a year or more on the average of a very comfortable existence, and that this comfortable existence is cheered by the knowledge that there is a possibility of cure, since, in some cases, irremovable glandular hyperplasia is the result of infection rather than metastasis. These experiences, acknowledged to be accompanied by a high mortality, have led us to extend the radical operation to a group of cases which we would have formerly considered inoperable.

The most serious technical question concerns the form of reunion of the gastric stump to the intestine after the removal of extensive disease. The gastric stump is small; it has already been seriously devitalized, and the gastro-enterostomy still further devitalizes the already damaged gastric wall. I am referring now to the Billroth method No. 2; that is, complete closure of the duodenal and gastric

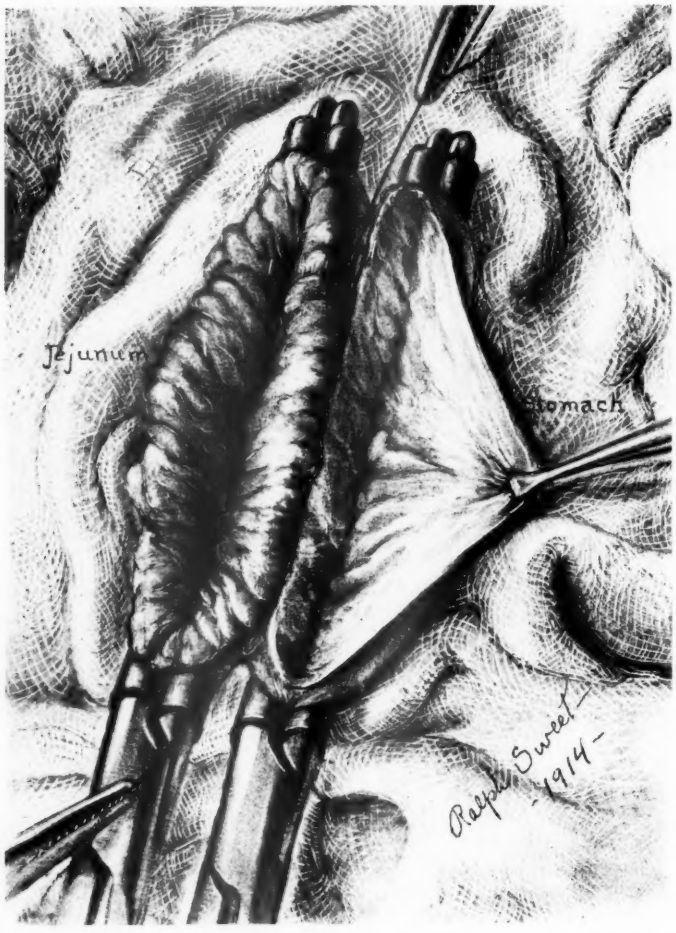

Fig. 5. Crushing clamp removed from the stomach and holding clamps applied to jejunum and stomach to prevent soiling.

stumps with an independent gastrojejunostomy, which has become, up to the present time, by virtue of its many advantages, the operation of choice by the majority of surgeons of the world.

The Billroth operation by method No. 1, that is, implantation of the duodenal stump into the narrowed end of the stomach, is not applicable in these cases since the gap is too wide and the tension would be too great.

The operation of Kocher, in which the end of the duodenum is implanted in the posterior wall of the stomach, for the same reasons is inapplicable, although its distinguished originator advanced the field for his particular method by suitable mobilization of the duodenum.

It was with much interest, therefore, that I investigated the method of Pólya (8), in which, after the excision is made, the end of the stomach is directly applied to the side of the jejunum, about six to twelve inches from its origin. Pólya reported six operations with three deaths, but it will be noted from the

Fig. 6. Inner row of catgut through-and-through sutures applied to the posterior walls, uniting jejunum to cut end of the stomach and continuing part way down the anterior wall.

case histories that the disease was very advanced in the patients who died. A number of operations (twelve) have been done recently in our clinic by this method with one death from pulmonary embolus, the autopsy showing perfect condition of the operative field. The technique employed is as follows:

The diseased portion of the stomach is removed in the usual way and the stump of the duodenum closed and buried (Figs. 2 and 3). An opening is made in the avascular arcade of the transverse mesocolon and the upper jejunum pulled through until it can be easily brought into contact with the stomach. The end of the stomach (Fig. 4), which is held in the crushing clamp of Payr, is united by suture to the loop of jejunum (Fig. 4) quite as the ordinary gastroenterostomy is made. If the diameter of the end of the stomach be very large, it can easily

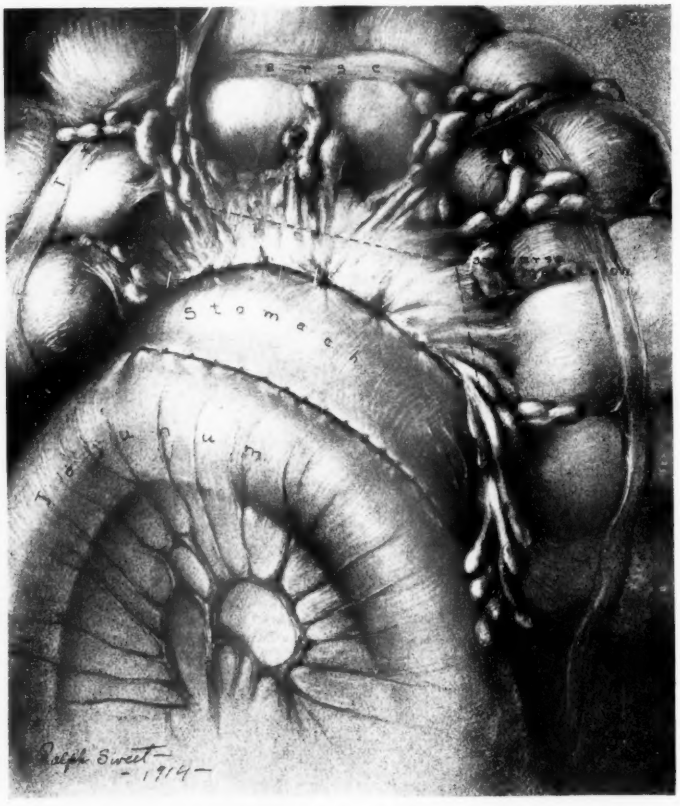

Fig. 7. Anastomosis completed by an anterior row of seromuscular silk sutures. Anastomosed end brought through the opening in the transverse mesocolon and margins of opening sutured to the stomach.

be diminished, by placing the sutures in such manner as to take a proportionately greater bite in the stomach than in the intestine, thus reducing the lumen of the stomach as the suturing progresses. The stomach is anastomosed to the jejunum at a point where the jejunal blood-supply is extraordinarily good, and the jejunum can be depended upon to do more than its share in the healing process (Fig. 5). Before the inner through-and-through sutures are placed, the stomach and intestine are grasped with elastic holding clamps to prevent soiling; the inner row of sutures is then run entirely around and the outer row completed (Fig. 6). The entire anastomosed end of the stomach is then drawn down below the transverse mesocolon and the margins of the opening in the transverse mesocolon carefully attached by a number of sutures to the wall of the stomach (Fig. 7). Fine silk is used for the peritoneomuscular sutures and chromic catgut for the through-and-through inner row.

This operation has some obvious advantages. It saves the time consumed in closing the end of the stomach, and in cases in which only a small pouch of the stomach is left, is very much easier than an independent gastro-enterostomy. Unless further experience shows some contra-indications, I predict for this procedure a large field of usefulness if it does not become the method of choice.

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"LAVANDERA'S ANKLE"

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WE are familiar with bursitis occurring in various and special bursæ according to the occupation or habits of various individuals in different walks of life and in different localities.

The inflammation of the bursa over the lower half of the patella popularly known as the "housemaid's knee" is probably the most common and universally observed. Other bursæ which are not infrequently inflamed are the bursæ over the tuber ischii and the bursa over the olecranon, the former commonly being known as "weavers' bottom" and the latter as "miners' or students' elbow."

These three bursitides result from chronic irritation applied to bursæ which exist as normal structures. Similar cavities known as abnormal or adventitious bursæ are not infrequently developed in regions where exceptional pressure is applied upon some prominent structure. Histologically, they consist of a fibrous wall the lining of which is a serous membrane, and contain a small quantity of serum. These are formed by dilatation of lymphatic spaces or are the result of localized effusion into the tissues. Examples of adventitious bursæ are met with in men of special occupation; e. g., Covent Garden porters have bursæ over the vertebra prominens (known as "hummy"), and Billingsgate fish carriers have bursæ under the center of the scalp.

In Manila we find a bursitis (Fig. 3), which might appropriately be termed "lavandera's ankle." Many of the washerwomen, or, as they are popularly termed from the Spanish period, *lavanderas*, do their washing in the rivers; and generally a flat rock which is close to the surface of the water and well down in the river is selected. The position assumed when working is such that the lateral aspect of the leg is next to the rock, the external malleolus thus coming forcibly in contact with the hard surface. The weight of the opposite leg rests upon the median aspect of

Fig. 1. a Bursa subcutanea malleoli lateralis.

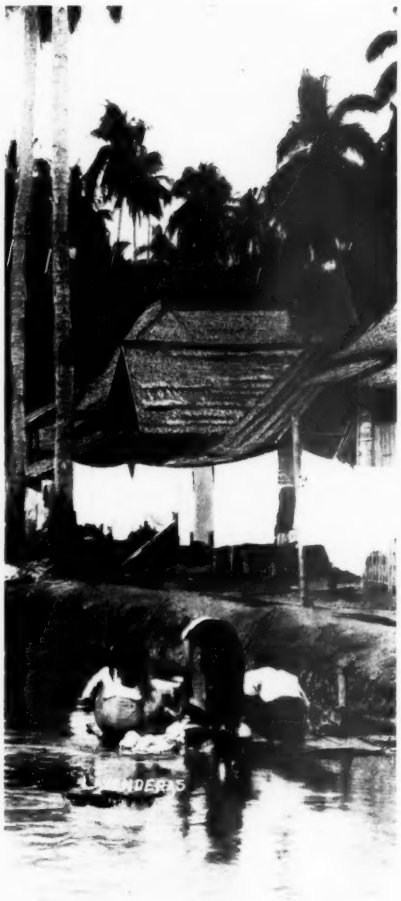

Fig. 2. Lavanderas at work.

the leg next the rock. And thus with the to-and-fro scrubbing movement a considerable pressure is applied over the prominence of the external malleolus.

Fig. 3. "Lavandera's ankle," showing the characteristic spurlike appearance caused by hypertrophy of the subcutaneous bursa over the prominence of the lateral malleolus. Patient from the writer's service, Philippine General Hospital, Manila.

Anatomically, there exists normally a bursa between the integument and the prominent subcutaneous bony projection of the external malleolus. This is the bursa subcutanea malleoli lateralis (Fig. 1).

Histologically, the walls of the bursa are found thickened, and the pathological process may well be classified as chronic fibroid or proliferative bursitis.

THE OPERATIVE TREATMENT OF CARCINOMA OF THE PENIS[1]

By JOHN H. CUNNINGHAM, Jr., M. D., Boston

CARCINOMA of the penis is not common, but it is nevertheless one of the most important diseases with which the genito-urinary surgeon has to deal. Paget states that it comprises only 1 per cent of all cases of carcinoma; Billroth puts it at 3 per cent. In 33 years Barney found less than 100 cases at the Massachusetts General Hospital, and at the Boston City Hospital I can find but 27 cases during the past 17 years. The small number of cases, however, makes it even more important, for, as we all realize, it is the rarity of a disease that leads to mistakes in diagnosis at a time when treatment might be successful.

Carcinoma of the penis, as elsewhere, invades the tissues and enters the lymph-vessels, giving rise to metastases along the paths of absorption. It occasionally invades the blood-vessels and causes secondary growths in various parts of the body; and carcinoma originating on the penis has the same distressing outcome as characterizes carcinoma originating elsewhere in the body. It is with the idea of emphasizing the necessity of early diagnosis, the location of the metastasis, and the best manner of dealing with the condition by operative measures, that this communication is made.

Etiology. This disease has a few special characteristics in causation worthy of mention. There is evidence which points to the belief that the disease may be carried from husband to wife and *vice versa*. Demarquay, MacFarland, and Bruce each mention cases in which contact with the cancerous cervix seems to have been the etiological factor. It is interesting to note that Travers, Patterson, Barney, and others have shown the immunity of the Jew from this disease,— which is suggestive, at least, that early circumcision may have some influence against the development of the condition. Writers upon this subject are inclined to regard phimosis as important in the causation of carcinoma of the penis and argue that phimosis causes a retention of smegma and urine, which they consider to be a predisposing factor.

Kaufmann, in recording a series of 33 cases of carcinoma of the penis, states that he believes that 29 began as venereal warts. Demarquay in a series of 59 cases states that he believes the etiological factor to have been syphilis. Crippes, Martin, and Sibley each have recorded a case of epithelioma developing upon the scar of a syphilitic ulcer, and I too have had one case of this sort developing upon a syphilitic chancre which had been healed but a few months.

Pathology. In location, carcinoma of the penis is primary on the glans penis or the reflection of the mucous membrane from behind the corona to the prepuce and rarely in the fossa navicularis. The glandular portion of the penis is of ectodermic origin and the new-growth is therefore of the epidermic variety, although Vander Veer has reported a case of mixed carcinoma and fibrosarcoma.

The growth is almost always papillary in form in the beginning, and even when quite well advanced often suggests a benign papilloma or hyperplastic epithelial formation of inflammatory origin, known as condyloma acuminatum, which frequently forms on the glans penis. Infiltration or invasion of the tissue at the base of the growth is often very slight until the growth reaches a considerable size, and this fact accounts in many instances for the failure to recognize the disease early as carcinoma. When the growth is of considerable size and cauliflower-like in type, with an ulcerated surface infiltrated at the base and with the presence of nodes in the inguinal region and in Scarpa's triangle, the recognition of the true condition is simple; but it is not so when the growth is small, papillary in character, with little or no infiltration at the base, and when inguinal lymphatic nodes are not demonstrable. If all patients in the cancer age who present themselves with what appear to be venereal warts are given the consideration which they deserve, a study

[1] Read before the American Urological Association, Philadelphia, June, 1914.

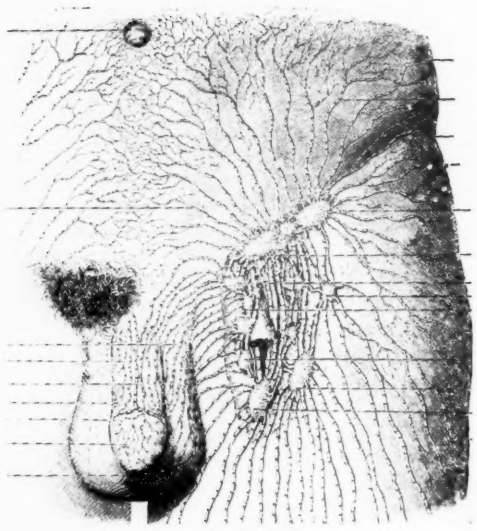

Fig. 1. Glands of the inguinal region; afferent and efferent lymphatics. (Taken from Sappey's Atlas.)

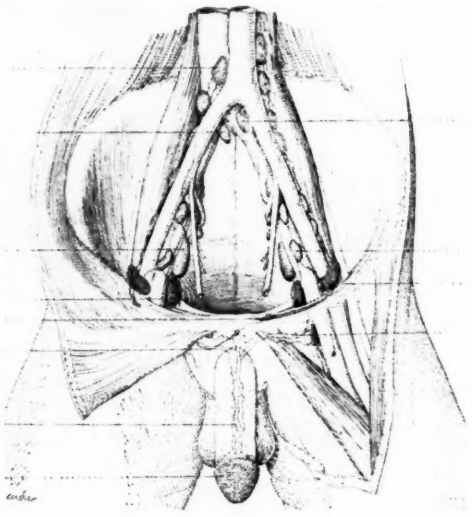

Fig. 2. Lymphatics of the gland in the new-born infant. (Cunéo and Marcille.)

of the histology of the growth will be made if the least suspicion in regard to its character is entertained. This is not putting any limitation on our clinical differentiation of a simple benign condition from a serious malignant one, for the correlation of the clinical aspects with the histology is fundamentally correct in this, as in all other tumor growths; and the importance of recognizing any evidence of malignancy cannot be overestimated. Again let me refer to Kaufmann, who states that he believes that 29 out of 33 cases in his series of carcinoma of the penis started as venereal warts; and it is well established in the minds of pathologists that warts of this type do sometimes undergo malignant degeneration.

Early recognition of the true character of the growths as benign or malignant is most important to deal successfully with them, for observations have established the fact that metastases are common and may occur early and beyond reach of surgical intervention.

Metastasis. To comprehend clearly the lymphatic distribution of carcinoma of the penis, a consideration of the lymphatic system of this region is important.

The lymphatics of the penis, scrotum, thigh, and lower half of the abdomen all are part of the one system which drains into the nodes of the inguinal region and Scarpa's triangle (Fig. 1). These nodes have been classified by anatomists into a superficial group and a deep group, with subdivisions; but from a clinical point of view the various subdivisions of this classification of the superficial and deep glands are of little importance, for all nodes of this region have no absolutely fixed relationship other than being superficial and deep, and all nodes of the superficial and deep groups may be invaded by metastasis from the disease under consideration. From the clinical aspect, the division of the nodes of the inguinal region and of Scarpa's triangle into superficial and deep, suffices. It is the involved superficial group of nodes that are commonly detected in the examination and removed at operation, and it is the deep group that is usually not considered or sought for and removed, with the result that when the deep groups harbors metatases and are left at operation it is in this region (Scarpa's triangle) that recurrences are most commonly observed. The deep inguinal nodes, usually three in number, are situated internal to the femoral vein, the lowest at the point of union of

the external saphenous and femoral veins, the others occupying the crural canal. These nodes are continuous in the pelvis with the internal chain of the external iliac nodes (Fig. 2). The deep group receives different vessels from some of the nodes of the superficial group and the lymphatics from the glans penis in the male and the clitoris in the female. It is important to keep in mind the deep group of inguinal glands as possible receptacles for metastasis, in cancer of the penis, for from this group the nodes of the pelvis may become involved.

The lymphatics of the urethra require mention. This system arises from a network of lymphatic vessels in the urethral mucous membrane, from the meatus to the prostatic urethra. The point of practical importance is that some of these different lymphatics terminate in the deep group of inguinal nodes situated in the crural canal and others in the internal chain of the external iliac nodes continuous with them as seen in Fig. 2. Other afferent vessels pass over the symphysis and terminate directly in the internal iliac nodes (Fig. 3). In other words, the lymphatics of the urethra pass directly to the deep inguinal nodes and the nodes within the pelvis without any connection with the superficial inguinal nodes, which is important to realize if the primary growth involves the urethra. To summarize briefly, the lymphatics of the penis may be divided into, three groups: *first*, those of the superficial covering of the penis draining into the superficial inguinal nodes which in turn anastamose with the deep inguinal nodes; *second*, the lymphatics of the glans penis, which drain into the deep inguinal nodes and in turn anastamose with the external iliac group in the pelvis; *third*, the lymphatics of the urethra, which drain into the deep inguinal nodes with the lymphatics of the glans penis and another system which passes over the symphysis and directly into the nodes in the external iliac group.

To determine the frequency of the distribution of metastasis via these lymphatic routes, I have examined the protocols of the Boston City Hospital and the Long Island Hospital in which cancer of the penis occurred, but in no record was there any information which throws the desired light on this subject.

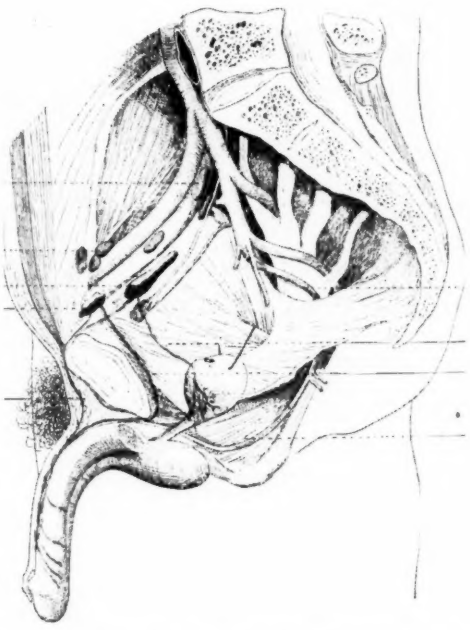

Fig. 3. Lymphatics of the penile and membranous portion of the urethra. (Cunéo and Marcille.)

In regard to the location of metastases, the clinical observations, however, have some significance. The cases operated upon at the City Hospital (primary operations) show the following:

There were 27 cases during the past 17 years. In 21 instances the clinical diagnosis was corroborated by histological diagnosis. In six cases the diagnosis was only clinical. In eighteen cases the metastases were noted as superficial or in the inguinal nodes; four cases were superficial and deep, one as involving the nodes of the groin; in two cases no metastases were present; and in two cases no mention of metastases was made. In my own clinical series of eight patients metastases were present at the primary operation in seven, all bilateral. One developed a recurrence in the groin, only the superficial nodes being removed at the primary operation, at which time one-half of the penis was ampu-

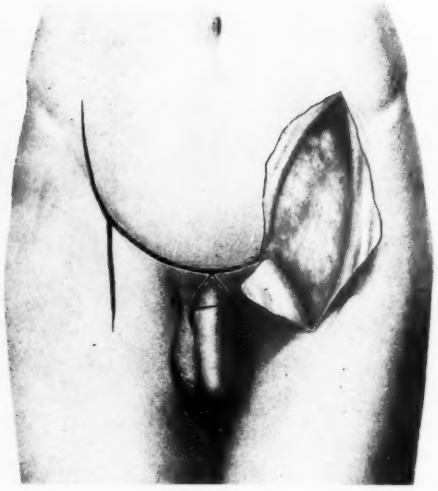

Fig. 4. Shows penis incased in cundom. Lines of incisions. Abdominal and inguinal fat mass partially freed.

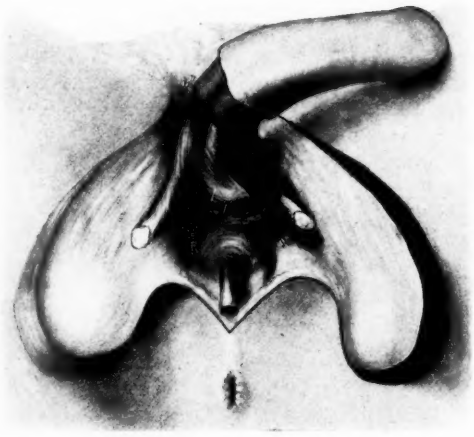

Fig. 5. Shows the scrotum bisected. The dorsal vessels tied. The crural separated from the pubic rami and their stumps tied. The membranous urethra separated from the walls and the abdominal fat mass above.

tated. The remaining case, an amputation of the distal third of the penis, refused to have the groins dissected and there was no evidence of recurrence in the groin 6 months following operation. Nothing further is known about this patient. It is seen, therefore, that of eight cases, seven had metastases and the other may have had it at a date later than 6 months.

Barney, in a series of 66 cases in which the glandular condition was noted, states that 75 per cent showed metastases present, that the involvement was mostly bilateral, and that in many instances the metastases occurred early in the disease. He also notes that 15 per cent were in vital organs. Kaufmann in a series of 48 cases found that 40 had carcinomatous metastases in the inguinal nodes, and that 30 of the 40 were bilateral. Kuettner in a series of 60 cases states that the inguinal nodes were involved in 70 per cent, although only 32 per cent were proved to be cancerous.

Barney, in a series of 100 cases operated upon by various methods, found 26 cases in which recurrences of the disease took place. That recurrences are common is evident from the literature on this subject. It is also evident that the inguinal nodes are invaded not only by carcinoma from the primary growth, but also by a secondary inflammatory process, which is so often present, and that gland suppuration often results.

Operation. As has been pointed out, the primary growth usually involves the distal portion of the penis and metastases take place along the lymphatic channels of the penis to the superficial inguinal nodes, then to the deep inguinal nodes, and then under Poupart's ligament to the iliac nodes within the pelvis. If the urethra has been involved by the growth, metastases may take place through the lymphatic channel, passing over the symphysis directly to the pelvic nodes. As has been noted also, the lymphatic channels of the lower half of the abdomen drain into the superficial inguinal nodes. It is necessary, therefore, to remove these channels in great part, in order to prevent a lymph block, when all the lymphatic nodes of the inguinal region are removed. The operative procedure is therefore twofold: *First*, to remove the growth and the lymphatic channels through which metastases take place; and *second*, to destroy the secondary lymph-channels which also drain into these nodes. The aim of the operative procedure about to

be described is to remove the penis, the fat carrying the lymphatics, and the lymph nodes all in one mass. This has been successfully done by the following procedure:

1. A cundom is placed over the penis to prevent implantation of cancer-cells during the operation.

2. A sweeping U-shaped incision is made, beginning slightly above and to the inner side of the anterior superior spine on one side, downward in the fold of the groin to the root of the penis, and upward on the other side. This incision passes just through the skin (Fig. 4) and outlines an apron, which is dissected upward.

3. An incision passing just through the skin is made downward over Scarpa's triangle from the center of Poupart's ligament. The skin is dissected inward and outward, making two flaps (Fig. 4).

4. Beginning at the top of the abdominal incision, the fat which contains lymphatic channels is dissected in one mass from the abdominal fascia. This dissection is carried downward into Scarpa's triangle on either side. The superficial nodes are removed still imbedded in the fat if possible. Hæmorrhage during the abdominal portion of the dissection is slight, but as the dissection is carried over Poupart's ligament into Scarpa's triangle, the superficial epigastric, the superficial circumflex, and the superficial external pubic vessels must be secured beneath the fat mass as they come through the fascia. If the node involvement is marked, the growth may extend as one mass through the fascia lata into the deep inguinal nodes, in which event the fascia is divided. The sartoris is drawn outward if necessary and the involved nodes freed from the femoral vessels. Poupart's ligament may be divided to continue the dissection into the crural canal. If the mass is not continuous from the superficial to the deep nodes, the fascia lata is divided and the deep nodes freed from the femoral vessels and removed.

5. The patient is then placed in the lithotomy position. An incision is begun at the root of the penis passing around both sides, uniting beneath and continuing along the raphæ of the scrotum, bisecting it. The suspensory ligament is divided and the dorsal vessels of the penis secured. The penis with the attached fat mass from the abdomen and groins is drawn downward. The dissection is carried on until the attachment of the cruræ to the pubic rami is met. These are clamped close to the bone and cut away. The stump is transfixed and tied, and no hæmorrhage results (Fig. 5). It is necessary to clamp, transfix, and tie, for the arteries to the cruræ may otherwise retract and cause troublesome hæmorrhage. Then the corpus spongiosum is freed at a distance of about three-fourths of an inch in front of the bulb and cut across at this point, unless the membranous urethra seems sufficiently long. It is better to leave too much than too little urethra. The whole mass, the abdominal and inguinal fat containing lymphatics and nodes, the penis, and the cruræ, are then removed in one mass.

Fig. 6. Shows the wounds closed with drainage. The urethra stitched in the perineum. The scrotal wound partially closed in the line of incision and partially by converting the incision into a lateral wound.

6. The cut end of the urethra is then stretched to the lower part of the perineal incision, and a self-retaining catheter placed through the urethra into the bladder. A drain is placed in the perineum, also in the wound of the abdominal skin apron on either side, and in the incision, in both Scarpa's triangles (Fig. 6).

7. The manner of suturing the scrotum, whereby it is lifted upward, so that it will not become soiled by urine is important.

Operative results. The literature in regard to this point is unsatisfactory. Barney's contribution is the only one which gives satisfac-

tory data. He states that in his series of cases one patient was free from the disease 4 years after the operation, one 8 years, one 9 years; and in eight cases the average length of life after the operation was 24 years. One of these patients was alive 30 years after operation.

In my own series, comprising eight cases, two had what I choose to call a partial operation; that is, amputation of the penis without dissection of the groin and Scarpa's triangle. One of these two cases had an amputation of the penis and removal of only the superficial nodes, followed by a recurrence in Scarpa's triangle on both sides, probably from the deep inguinal nodes which were not removed because they were not palpable. It was an error not to have removed them. The other case refused to have the groins dissected. There were no palpable nodes at the time nor did any develop during the following six months. This was a favorable case for amputation. The remaining cases were subjected to the operation already described. Of these cases, one died eight days after operation from sepsis dependent upon infiltration of the wound by urine. One case is free from the disease 12 months following operation, another 14 months, another 26 months, one over 5 years, and another was free from the disease, when last seen, 5 years after operation.

Of the eight cases which I have operated upon only one of them is of special interest to detail.

CASE 1. E. F. S.; referred by Dr. R. W. Mathes of Lynn, September 25, 1910. Patient 29 years old. *History.* Gonorrhœa ten years ago; slight discharge ever since, not benefited by treatment. Circumcised one year ago upon advice of doctor for a simple phimosis. Syphilitic chancre three months following circumcision (nine months ago), rash in six weeks. Treatment begun with appearance of rash. (Protorodide gr. 1/4, three or four pills daily for two months.) All symptoms disappeared. Two months ago a sore appeared on penis at site of the chancre which progressed rapidly and became destructive. The patient lost ten pounds during the next two months.

Physical examination. General condition good; pale; general glandular enlargement. Skin, throat, ears, eyes, and scalp negative. On the dorsum of the penis extending half-way up shaft, and beginning at corona, was an ulcerated, irregular-edged sloughing ulcer resembling a broken-down gumma or carcinoma. Wasserman positive xxx. The patient refused to have any treatment other than mercury. This he received in the form of intramuscular injections and inunction for five months, during which time the growth on the penis became a large cauliflower-like ulcerated mass absolutely characteristic of carcinoma, and small nodes were palpable in both groins. It was only at this time that the patient consented to have the organ amputated, but he refused to have the urethra implanted in the perineum.

First operation. February 21, 1911. Penis amputated at root as close to symphysis as possible. Both groins dissected and superficial glands removed. No deep glands were palpable and the fascia lata was not divided. The femoral vessels were not inspected. The patient was given 0.6 gr. of Salvarsan at this time. Convalescence uneventful. Left hospital in ten days. Seven months after operation the patient was in excellent health, having gained 46 pounds, but presented himself on account of a swelling in the left Scarpa's triangle. Examination showed a mass almost as large as a lemon, beginning just below Poupart's ligament and extending downward into Scarpa's triangle. Wasserman negative.

Second operation. March 28, 1912. An incision over the inguinal canal extending downward into Scarpa's triangle over the mass; mass found to extend through fascia lata and into the inguinal canal. Inguinal canal opened; the vas deferens not involved; mass found to be beneath Poupart's ligament. This was divided and the mass freed from above downward into Scarpa's triangle. Femoral vessels exposed with mass adherent. The femoral artery was freed from the growth, but the femoral vein had been invaded by it. The mass was removed, leaving only the involved wall of the femoral vein, which was shaved down as thin as seemed wise. The divided structures were repaired. The convalescence was not remarkable in any way. The patient left the hospital in twenty days. It was believed that the bit of the growth left on the femoral vein would produce visceral metastasis which would soon end the patient's life. The patient remained surprisingly well, but nine months after the second operation he presented himself with a small lump in the left Scarpa's triangle; otherwise he was in excellent health.

Third operation. December 12, 1912. The old field was again opened and a mass adherent to the femoral artery and vein extending to the brim of the pelvis was found. The femoral artery could be freed, but the mass was so adherent to the femoral vein that four inches of it was removed. The vessels were followed into the pelvis where a pelvic mass of a considerable but indefinite size was discovered. The wound was repaired. The patient made a slow convalescence, delayed somewhat by sepsis in the wound. The leg swelled but little in consequence of the resection of the femoral vein. The patient

got about again, but evidence of metastasis in the abdominal organs, especially the liver, appeared within three months and he died May 7, 1913, five months following the last operation.

The chief points of interest in this case are, *first*, the development of carcinoma upon the site of a syphilitic chancre and *second*, the recurrence of the carcinoma in the group of deep nodes which were left at the first operation because they were not palpable. It is also interesting to note that there was little change in the circulation of the leg following the resection of the femoral vein.

In conclusion it would seem that we are not dealing with carcinoma of the penis as radically as we should and that recurrences from metastasis in the lymphatic nodes not sought for and removed at the primary operation can be overcome by more radical measures than are commonly employed.

TWO CASES OF FILARIASIS

With Autopsy Findings

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CASES showing the results of infection by filariæ are rarely seen in hospitals in the north temperate zone. Within a short time of each other two such cases were treated in the wards of the Royal Victoria Hospital, Montreal. In each case, after an acute febrile illness, death occurred and a post-mortem examination was permitted. It was thought that a short report of the clinical condition along with an abstract of the autopsy findings might be of interest.

Case 1. Female, colored, 14 years old; was admitted to the medical ward of the hospital August 1, 1912. She complained of a swelling in each groin which had been present for two years. She said that after walking the swelling would feel a little sore. This was her only complaint. Aside from this she claimed to be in perfect health. Up to a few months ago she lived in Antigua, British West Indies. Five years ago she had an attack of a febrile disease which she called malaria; she was ill on and off for nearly one year. Her father had suffered from filariasis.

She was a well-nourished, bright, healthy-looking, dark-skinned girl. Mucous membrane a good color; no dyspnœa; no cyanosis. Very intelligent. The inguinal glands were considerably enlarged, and were more prominent when the patient assumed the erect posture. They were the size of a hen's egg, had a baggy, varicose feel, were irreducible, gave no impulse on coughing, and were dull on percussion.

Leucocytes, 12,000; red cells, 4,600,000; hæmoglobin, 90 per cent. A differential count gave the following: Polymorphonuclear leucocytes, 70 per cent; large mononuclear leucocytes, 10 per cent; eosinophiles, 5 per cent; small lymphocytes, 15 per cent. Filaria with all the characteristics of filaria bancrofti were found in the blood.

The patient was transferred to the surgical side. The enlarged lymph-glands were removed on each side. Adult filariæ were not found in the excised tissue. The operation was not difficult and recovery was prompt. As long as the patient remained in the hospital the embryos could be found in the blood at night. She left the hospital feeling quite well, and happy to be rid of the lumps in the groins.

She was readmitted on June 3, 1913, eight months after the removal of the lymph-glands in the groin. She complained of sore throat, difficulty in swallowing, pain in the joints, slight headache, and general *malaise*. Her temperature was 103°; pulse, 136; respiration, 24. The glands on the right side of the neck were palpable and a little enlarged. During the next seven days there was little to note. The temperature gradually dropped to normal on the fifth day and remained so for 48 hours. On the eighth day it rose to 100.3°. She vomited quite frequently. Urine: acid; specific gravity, 1,022; albumin present; no sugar; no casts. On the tenth day her temperature was 103°, and on the following day it was 106°. She was somewhat delirious. Her leucocyte count on this day was 37,000, and a pure culture of streptococci was obtained from the

blood. She died on the twelfth day after admission to the hospital. For 24 hours before she died she was in a semi-unconscious condition. There never had been any rash.

Abstract of post-mortem report, Case 1. The body was that of a colored girl measuring 145 cm. in length, and of good physique and nutrition. The lips were blue. The teeth were well formed and in good condition. The pupils were equal and the conjunctivæ clear. The lymphatic glands were palpable. The chest was well formed, the mammary glands small; abdomen flat. The hair of the head was abundant, straight, and black. There were brown pigment spots on the face, two scars on the thighs from the removal of inguinal glands, and a scar on the inside of the left tibia. The subcutaneous fat was 2 cm. in thickness.

The heart weighed 165 gms. and measured 9 x 9 cm.; an excessive amount of blood was found in the pericardial sac. The microscopical appearance of the heart sections indicated an acute toxic degeneration.

Respiratory system: The trachea was pale; the bronchi and bronchioles were uniformly congested. There were minute focal hæmorrhages into the pleura, especially at the bases of the lungs. The lungs were œdematous and rich in blood. The histological sections showed acute congestion.

Digestive system: With the exception of slight œdema of the walls of the large intestine and paleness of the mucosa walls, nothing abnormal was found in the gastro-intestinal tract.

Liver: The liver reached 4 cm. below the costal border in the right nipple line; it weighed 1,400 gms. and measured 22 x 18 x 7.5 cm. It was firm, and its surface was smooth; it was not friable; cloudy swelling was marked. Sections showed passive congestion and fatty degeneration.

Pancreas: Soft and pink in color, the lobules loose in texture. The connective tissue was congested.

Urogenital system: The kidneys showed active congestion and cloudy swelling. The uterus was 7 cm. in length and 2 cm. in breadth. It presented no abnormalities. The ovaries were normal. The fallopian tubes on section showed the presence of a general fibrosis. No adhesions existed between the folds. The epithelium was well preserved and many cilia were detected. The centers of the villous processes were extremely rich in fibrous tissue, a condition which suggested previous acute changes. The blood-vessels were everywhere congested. The submucosa was fibrosed, the muscular coat thin. There was no inflammatory-celled infiltration.

Spleen: The spleen weighed 270 gms. and measured 9.5 x 14 x 4.5 cm. The surface was finely granular. The capsule was tense. The malpighian bodies were small, and many showed hyaline change. The pulp tissue was congested; at edges of malpighian bodies were numerous eosinophiles; pulp cords were indistinguishable.

Adrenals: The cortex of the adrenals was pale and the differentiation not good. The pigment was pale and the medulla gray.

Lymphatic glands: The striking lesion in this case was the wormlike enlargement of the lymphatics as far as they could be traced from the inguinal canal to the thoracic duct. The channels had a purple color and were extremely tortuous, especially about the fallopian tubes and in many of the pockets of the peritoneal cavity. Where lymphatic nodes were ordinarily situated, their contour was lost in dense plexuses of lymphatic channels. When cut into, they exuded a blood-stained, very watery fluid. These channels were conspicuous on account of their dusky color. They followed especially along the sides of the aorta. They could be traced into the liver, about the hilum of the spleen, around the adrenals, and up into the thorax along the side of the aorta. Sections of the lymph-nodes presented varying appearances. Some presented necrotic foci; others showed almost complete absence of lymph-tissue and replacement by a dense infiltration of polymorphonuclears and blood-cells; others, again, resembled sections of acute lymphatic leucæmia; and, in many, fibrous tissue was observed with focal hæmorrhages here and there. There was a distinct loss of differentiation in the majority of the sections, with absence of lymph-follicles, indistinguishable pulp-cords, and indistinct blood-channels. Numerous small hæmorrhages into the gland substance and a diffuse overgrowth of fine fibrous connective tissue were features of interest. A dense polymorphonuclear leucocytosis characterized other sections. Although a faithful search was made for adult filariæ, none was found in the tissues. Some sections suggested beginning calcification, yet microscopic examination was not confirmatory.

The most marked feature in many of the sections was the extensive fibrous tissue change, in places occluding what were once patent lymphatic channels.

Case 2. M. F., age 13. A young girl quite as dark of complexion as the first. On admission she complained of a painful swelling on the left groin, constipation, nausea, and vomiting. Her temperature was 103°. She was delirious and soon lapsed into a state of semi-unconsciousness. She had been ill only three days. Her first symptoms were chilliness, vomiting, slight headache, and general *malaise*. These symptoms persisted and were followed by marked prostration. The bowels did not move, and vomiting followed the taking of food. She complained bitterly of pain in the left groin. The swelling in the groin increased in size and the nausea and vomiting became very distressing.

She was born in British Guinea and had been in Canada only three months. No history of scarlet fever or other diseases of childhood; had never had pneumonia or pleurisy. The swelling in the groin had been present for two years. There had never

been any œdema of the feet or ankles. Family history negative.

It was quite evident that the girl was seriously ill. She assumed the dorsal decubitus, face flushed, eyes bright, conjunctivæ injected, no ecchymosis. Her respirations were 36, pulse small and of low tension. Would reply when spoken to. No rash; no subcutaneous nodes. There was a general glandular lymphadenoid hyperplasia. Tonsils large and soft, but did not show any evidence of active disease. Epitrochlear glands palpable. The left side of the groin was occupied by an irregular-shaped mass looking not unlike a hernia. It was soft to the touch and felt like a number of soft nodules, more or less separate. The mass was tender to touch and the overlying skin red and injected. No impulse on coughing; no gurgling; no bruit.

Respiratory and cardiovascular system negative. Abdomen somewhat distended, but otherwise negative. Leucocytosis, 13,000. No embryos could be found in the blood. The urine was clear, amber; specific gravity, 1,016; no albumin; no sugar; no pus, blood, or organisms.

Soon after admission she became very excited and shortly afterward apathetic. The day following her admission to the hospital her temperature rose to 104.4°; pulse, 124; respiration, 60. She became more drowsy and finally unconscious, and she died that evening.

A blood culture gave a growth of streptococcus, and the differential blood-count showed 4.5 per cent of eosinophiles.

Abstract of post-mortem report, Case 2. The body is that of a well-built young mulatto female of good nutrition. There was a small swelling in the left groin, but no other feature of interest externally. Permission for examination was obtained for the abdomen only. When opened, it was found to contain a moderate amount of blood-stained watery fluid. The tissues in the loins were remarkably juicy and thickened and had a semi-translucent appearance. There was apparently a diffuse subperitoneal extravasation of blood. In the rest of the mesentery this was a notable feature. At the mesenteric attachment there was also a slight amount of blood extravasation. On subsequent examination of the tissues, what had appeared to be extravasated blood was found to consist of widened lymphatic channels containing thin, watery, blood-colored fluid. The surrounding fat had a gelatinous appearance. The lymphatics were very tortuous and could be traced along the mesentery and into the hilum of the liver, where they formed a very broad, flat band of purplish color about 5 cm. in width. The glands between the stomach and the liver were very numerous, large, and watery. Throughout, the glands appeared to be converted into sponge-work channels containing watery fluid.

Along the aorta up into the thorax this extensive lymphatic change could be followed easily. The thoracic duct was lost in a line of dilated channels and attached glands, and occupying the whole of the anterior mediastinum was a flat leaf-like mass of glands resembling in color and a little in shape an ordinary fatty omentum.

By the side of this and on the left of the first part of the aorta was a large, smooth, reddish, oval swelling (8.8 x 5 cm.), of baggy consistence and unconnected with any structure save the lymphatic channels already referred to. When incised it was found to consist of a dense sponge-work with numerous wide channels (1 cm. in width) filled with watery, bloody fluid.

In the groin was a mass of enlarged glands, the superficial and deep femorals all being continuous. Many of these were suppurating and contained a very fatty pus, loaded with chains of streptococci. This mass was continuous with the deep inguinals, then with the lumbar glands, and finally blended with the retroperitoneal tissues described. Histologically, the glandular masses in the abdominal cavity and mediastinum were characterized by a great increase of fibrous tissue with almost entire loss of lymphoid tissue. Dilated sinuses and tortuous lymphatic channels surrounded by fibrous tissue were much in evidence. In the surrounding connective tissue, hæmorrhagic infiltration was marked.

A prolonged search failed to demonstrate filarial parasites, but the curious anatomical findings in this case and its close similarity to Case 1, which was known to be filarial, leave little doubt that this was a case of filariasis. The death may be ascribed to a virulent streptococcic infection of glands devoid of lymphoid tissue, allowing generalization almost immediately.

COMMENTS

Even the infrequent finding of cases of filariasis in Northern latitudes indicates that clinicians should bear this condition in mind when dealing with obscure pathological lesions of the lymphatic system in patients who have resided for some time in filarial districts.

The clinical manifestations of the two cases were similar. The outstanding feature of interest in the pathological findings was the presence in each case of a huge lymphatic varix, extending from the groin into the thorax. In some instances lymphatic varices are associated with a chylous exudate. This was not present in these cases. Frequently the extension of the varix into the groin so closely resembles a hernia that the mistake is evident only when the tissues have been incised for a radical cure. How these large varices are produced is not well understood. Evidently, the irritation of the parasites produces a marked change on the endothelial lining of the lymphatic channels, and,

along with the inflammatory cell-exudate, the marked fibrosis, and the pressure from lymph, may be considered a factor aiding in the production of the varices. Experimentally, occlusion of the thoracic ducts does not always produce a varicose condition of the lymphatics.

The association of fibrosis with filarial infection is well shown in cases of elephantiasis, where the fibrous-tissue extension is marked in the cutaneous and subcutaneous areas. The patent channels of the varices in our cases were not occupied by lymph, but by blood and blood-stained lymph. Possibly the rupture of small blood-vessels into portions of the varices may explain this finding.

The origin of the terminal infection in each case was impossible to place with precision. It may have started about dead adult parasites. The fibrosis and destruction of the lymphatic system consequent upon the filarial invasion, so evident on microscopical examination of the tissues in our cases, was so great that even an ordinary infection might have resulted fatally in patients deprived of those bulwarks of defense.

Bahr describes six cases of what he terms filarial fever in which sudden onset, high temperature, leucocytosis, eosinophilia, and microfilariæ in the blood were the leading features of interest. The sudden onset, temperature, and leucocytosis are common to many infections; they might in cases of filariasis be attributed to a streptococcic or staphylococcic infection about dead adult filariæ, and the condition might be termed filarial fever in the sense that it occurred in patients suffering from filariasis.

Eosinophilia is a feature of great interest in filarial infection. They have been found even more numerous when the peripheral circulation swarmed with microfilariæ. Three species of filariæ are fairly well recognized as human parasites. Of the three, filaria bancrofti has received the most attention in the literature. The adult filaria bancrofti measures about 38 mm. in length, is filiform in shape, and resembles an animated gray hair. It possesses a globular head and its mouth is unarmed. The male is smaller and less numerous than the female, and is found as a rule in the lymphatic channels and glands of the body. In the uterus of the female, eggs may be found in various developmental stages. When mature, they are discharged into the lymph-stream, after a time reach the right side of the heart, and eventually find their way into the peripheral circulation. These microfilariæ are filiform in shape and measure about 300 μ. in length and from 7 to 8 μ. in breadth. They are in length about 30 times the size of a red blood-corpuscle. Each individual embryo is enclosed in a membrane. The number found in the blood varies greatly at different times during the day and night. The marked characteristic of filaria bancrofti is its appearance in the peripheral circulation at night. Thus from 5 P. M. until midnight they are found in large numbers; from midnight till daylight they gradually decrease, and during the day only an occasional one may be found. During the day they retire to the lungs and the large thoracic vessels. The reason of this periodicity on the part of the microfilariæ bancrofti is not known. It is presumed that the sleeping time of the patient has something to do with it, while others think it is connected with the feeding habits of the intermediary mosquito host. Bahr contends that the non-periodicity of the Fijian and Samoan filariæ is explained by the day-feeding habits of the mosquito. Manson has found as many as 500 microfilariæ on a single microscopic slide and it has been estimated that from forty to fifty millions circulate in the average adult-infected individual. Many are killed in the tissues, supposedly by the endothelial cells and by the blood-ferments. In order to attain maturity the microfilariæ must be taken into the body of certain mosquitoes found in filarial districts. Without proper protection in tropical climates and with microfilariæ swarming the peripheral circulation at night, it is not difficult to understand how this is accomplished. Ingested along with some blood into the mosquito's stomach, the microfilara loses its vitelline membrane and shortly afterward finds its way through the stomach-wall. In the thoracic muscles of its host it attains a size of 1.5 mm. and when further developmental processes have taken

place it reaches the salivary organs. When the mosquito bites (man, for instance), it is discharged into the wound, reaches the circulatory system, lodges in the lymphatic glands or channels, and in the course of time attains adult dimensions. The number of adult filariæ that may be found in the tissues is considerable, but it is by no means as large as the number of microfilariæ. In filarial districts the majority of the inhabitants, on examination of the blood, reveal the presence of microfilariæ, but show no marked symptoms or signs of the infection. Only a small percentage show the results of the invasion, in one or more of the following conditions: lymphangitis, varicose inguinal glands, lymph scrotum, hydrocele, chylocele, chylous pleurisy and peritonitis, chylous urine, abscess formation, elephantiasis. The adult filariæ may be found in the lymphatic glands and vessels. In these situations they may die, and the site of their death is often the starting point of a local or generalized infection. Sometimes they calcify after death; but, alive or calcified, they produce fibrosis of lymphatic tissues and blocking and destruction of lymphatic glands and channels. Eosinophiles are present in large numbers around living or calcified filariæ.

Destruction of lymphatic tissue, and ensuing fibrosis as a result of filarial infection has been frequently pointed out. One of the theories advanced explaining the causation of elephantiasis from filarial infection rests on the fact that in these cases there is frequent blocking of intra-abdominal lymphatics. This blocking may be due to the filariæ themselves, to endothelial proliferation from filarial irritation, or to circumscribed fibrosis.

Failure at autopsy to find adult filariæ in cases known to have been infected has been noted by other observers. Bahr, who published a report on filariasis and elephantiasis in Fiji, found at post-mortem examination of cases known to have had filariasis, but dying of other causes, extensive varicosities of the abdominal and thoracic lymphatics, but not in every case were the adult filariæ discovered. He also describes an autopsy on a case of filarial fever which revealed, in addition to calcified filariæ and extreme lymphatic varicosities, great fibrosis and destruction of lymphatic tissue. Four cases of septic infection following filarial invasion were noted, with recovery in each case. But of eight cases of abscess formation, in one only were adult filariæ found in the excised and drained tissues. He is of the opinion that surgical treatment is of little avail as a curative measure for filariasis. Benefit to the patient undoubtedly results from incising and draining the broken-down glands, due primarily to filarial, and secondarily to streptococcic and staphylococcic, infection. But, for a cure to follow the accidental discovery and removal of adult filariæ from incised tissues is not always probable or possible. It might happen that the patient was harboring only the adult organisms discovered at operation, but as a rule other adult filariæ are present in the deep lymphatics of the trunk.

Cunningham has reported a case of filariasis in which at operation inguinal varicosities were found to extend into the abdomen. He found no adult filariæ in the excised masses and no evidence of their presence on microscopic section of the tissue. Primrose considered that the cure of a case of filariasis in which filarial lymph-scrotum was present and operated on by him was due to the finding of the adult worm in the tissue removed at the time of operation. He advanced in support of his contention the absence of microfilariæ in the blood sixty-seven days after operation; he refers to the experience of Maitland and others who obtained similar results from the same procedure. Manson was of the opinion that the cure occurring in Primrose's case followed an attack of lymphangitis of the neck forty-six days after the scrotal operation which led to the removal of a sloughy mass in the neck. The occurrence of lymphangitis (so common in filarial cases) may have indicated the presence of dead adult worms in the neck lymphatics unrecognizable when removed in a sloughy mass.

Bahr relates an interesting case of disappearance of microfilariæ from the blood in some respects similar to the cases in which filariasis seemed to be cured by surgical intervention. The patient had microfilariæ

up to an attack of filarial orchitis along with adenitis of the groin. After this they could not be found. Pure cultures of streptococci were recovered from the pus in the groin. He relates a number of cases where the microfilariæ disappeared from the blood, and states that in every such case some inflammatory disturbance preceded the disappearance. No explanation is offered for this result. A clinician would be inclined to attribute the disappearance of the parasities to some therapeutic measure which he had employed, and not to an inflammatory process which was seemingly a coincidence.

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STOKES. Med. Rec., 1911, Jan. 28.

SURGICAL MYXORRHŒA COLI, MYXORRHŒA MEMBRANACEA AND MYXORRHŒA COLICA[1]

(MEMBRANOUS ENTERITIS AND COLICA MUCOSA)

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IT is difficult to define membranous colitis and mucous colic because *they are not a disease but a symptom-complex* characterized by copious, periodic mucous discharges, abdominal discomfort or cramps, and constipation (spastic), characteristics which vary greatly in different cases and under varying circumstances, and finally because the same patient may at one time seek relief from mucous colic or at another from excessive mucomembranous evacuations. Myxorrhœa coli occurs more frequently in women and in asthenic individuals than in laborers, but is exceedingly rare in the very old and in the young.

The nomenclature of these conditions is confusing, and authorities of repute have coined more than twenty captions to indicate their interpretation of mucous colic and membranous colitis; viz., membranous enteritis (DaCosta), colico mucosa (Nothnagel), tubular diarrhœa (Mason Good), pseudomembranous enteritis (Cruvehier and Laboulbene), myxoneurosis coli (Ewald), myxorrhœa neurosa coli (Albu), mucous disease (Whitehead), intestinal neurosis (Siredey), croupous enteritis, mucous croup, and colitis pseudomembranacea.

Owing to the fact that mucus responsible for these conditions is secreted or collects within the colon, to eliminate the confusion which exists concerning the nomenclature of so-called membranous enteritis and colica mucosa the writer suggests that the caption "myxorrhœa coli" be applied to all mucous stools; "myxorrhœa membranacea" to evacuations characterized by strings, strips, or bowel-like membranous mucous casts; and "myxorrhœa colica" to mucoid collections inducing colic. Then by adding the prefix "myxorrhœa" to the factor responsible for the hypersecretion or retention of mucus, myxorrhœa coli could be classified as follows: Myxorrhœa catarrhalis, myxorrhœa constipativa (e constipatione), myxorrhœa spastica (enterospasm), myxorrhœa traumatica, myxorrhœa infectiosa, myxorrhœa dyspeptica, myxorrhœa toxica, myxorrhœa obstructiosa, myxorrhœa nervosa, myxorrhœa organosa, myxorrhœa parasitica, etc.

Etiology. Formerly, authors attributed myxorrhœa colica and myxorrhœa membranacea to neuroses which led to the hypersecretion of mucus. Later Nothnagel claimed the two might be caused by neuroses or intestinal catarrh. Recent investigations have

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shown that these manifestations may also be induced experimentally and by a variety of conditions.

Clinicians agree that nervous phenomena, viz., hysteria, neurasthenia, melancholia, and trophoneurosis, are frequently observed in persons who suffer from myxorrhœa colica and myxorrhœa membranacea, and they are willing to concede that organic or functional nervous affections or psychic disturbances may induce or aggravate them.

The chief claims in favor of the neurotic origin of myxorrhœa membranacea and myxorrhœa colica are based upon the nervousness of such patients and the normal appearance of the mucosa which frequently obtains during life and at autopsy. Many reasons, can be advanced to prove that mucous colic and membranous colitis are frequently produced in other ways, as follows:

1. Few patients afflicted with insanity, hysteria, melancholia, or other nervous affections suffer from myxorrhœa coli.

2. Mucous discharges may occur independently or complicate nervous diseases.

3. Myxorrhœa colica and myxorrhœa membranacea may obtain for years without the patient becoming nervous.

4. Frequently neurogenic disturbances do not appear until months or years after the onset of myxorrhœa coli.

5. Correction of associated neurogenic disturbances often fail, while therapeutic measures directed against local or general disease causing intestinal irritation succeed.

6. The frequency of myxorrhœa membranacea and colica in women, and the fact that they are usually encountered between the twentieth and forty-fifth years, indicate that abnormal menstruation sometimes influences the hypersecretion of mucus.

7. Atonic or spastic constipation usually precede or accompany mucous stools and are probably a factor in their causation, since they frequently cease when regular evacuations are established.

8. Copious discharges of membranous or jelly-like mucus, with and without colic, follow frequent or prolonged alum, silver nitrate, copper sulphate, mercury, tannic acid, glycerine, and iodine colonic irrigation.

9. It has been demonstrated experimentally that the secretion of mucus can be augmented by iodine, silver nitrate, or alcohol applications to the intestinal mucosa, reflex action through other organs or the solar plexus, and by injecting rabbits with sodium oxalate, subjecting them to infection, having them eat indigestible food, and stimulating the intestinal nerves with electrical currents.

10. Patients suffering from myxorrhœa coli usually have previously suffered from gastro-intestinal or systemic disturbances.

11. Owing to the similarity of mucous discharges in intestinal catarrh and mucomembranous colitis, it is often impossible to dissociate them.

12. Mucus may be constant in colitis; but when mucous stools appear periodically, colic ensues, and the mucoid discharges are membranous, it indicates that myxorrhœa colica or myxorrhœa membranacea are secondary to intestinal catarrh.

13. Mucomembranous evacuations and colic have followed fermentation and putrefaction and very likely are caused by excessively active colon bacilli or other intestinal micro-organisms and their toxins.

14. Myxorrhœa membranacea and myxorrhœa colica are occasionally associated with intestinal helminths which irritate the mucosa.

15. Intestinal stasis and auto-intoxication frequently complicate myxorrhœa membranacea and myxorrhœa colica and probably cause them in some cases.

16. Myxorrhœa colica and myxorrhœa membranacea are occasionally a manifestation of foreign bodies (intestinal sand, enteroliths, bismuth accumulations, and scybala) which traumatize the intestine.

17. Colonic coprostasis is accompanied by nerve phenomena and mucous evacuations, which disappear when it has been corrected.

18. The expulsion of jelly-like or inspissated mucus is not characteristic of particular affections, but is a reactionary phenomenon occurring under varying conditions; and Tremolière says that mucous stools do not represent a specific factor more than does mucous sputum a specific disease of the respiratory tract.

19. Mucous colic and membranous colitis may be secondary to defective metabolism in phlegmatic or nervous individuals.

20. It has been demonstrated by bowel inspection that myxorrhœa colica and myxorrhœa membranacea may be induced by organic changes in the mucosa.

21. Finally, it is sometimes difficult to determine whether myxorrhœa coli is dependent upon affections of the nerves, systemic disturbance, inflamed mucosa, or obstructing lesions, because one or all may be factors in the same case and produce the symptom-complex of myxorrhœa coli.

The writer has treated patients for myxorrhœa coli where multiple and widely varying factors played a part in its production; hence, he is constantly on the lookout for more than one cause.

Myxorrhœa coli not infrequently complicates atrophy and atony of the large intestine and has suddenly appeared during and following: diphtheria; scarlet fever; measles; ptomaine poisoning; influenza; typhoid fever; chemical poisoning; and disturbances of the liver, gall-bladder, pancreas, and kidneys.

Gastrogenic disturbances (achyliagastrica, hyperchloridia, and cancer) which unbalance the secretion, lead to its stagnation, or interfere with gastric motility, occasionally lead to mucomembranous colitis; and myxorrhœa coli has accompanied enterogenic disturbances which modify the succus entericus.

Frequently myxorrhœa colica and myxorrhœa membranacea are symptoms of catarrhal, syphilitic, tubercular, balantidic, entamebic, coccidic, flagellate, bacillary, helminthic, and other types of colitis.

Myxorrhœa coli may also be induced by scybalæ, purgation, irritating drugs, enteroclysis, massage, vibratory treatments, or anything which irritates or inflames the mucosa or causes constipation, intestinal obstruction, enterospasm, or fæcal retention; and it has been known to follow the rough handling of the intestine, abdominal viscera, and pelvic organs during operation and careless introduction of the sigmoidoscope.

Individuals afflicted with myxorrhœa membranacea and myxorrhœa colica have a lowered vitality, are under weight, act slowly, and frequently suffer from anomalies of the teeth, nails, or hair, movable kidneys, enteroptosis, uterine procidentia, hæmorrhoids, varicose veins, hernia, insufficiency of the tissues (connective, nervous, and muscular), and nutritional trophic disturbances of the lymphoid and mucous glandular mechanism (adenoidism).

Rhinopharyngeal lesions (vegetations, etc.) and intestinal disorders compose the symptom-complex of adenoidism observed in thyroid disease, which is an important factor in myxorrhœa membranacea and myxorrhœa colica. Tremolière holds that atrophy and hypertrophy of the thyroid gland are frequently associated with myxorrhœa coli, and when it is not so associated, the liver, kidney, or some other organ is involved and causes faulty metabolism, malnutrition, or trophic changes and myxorrhœa membranacea or myxorrhœa colica.

Myxorrhœa membranacea and myxorrhœa colica may be aggravated or caused by any of the following surgical diseases or conditions; viz., congenital deformities of the bowel, foreign bodies, relaxed abdominal walls, movable cæcum, splanchnoptosis, malignant and non-malignant neoplasms, peritonitis, appendicitis, salpingitis, diverticulitis, pericolitis, adhesions, tumefactions, invagination (intussusception), volvulus, extra-intestinal pressure, stricture, angulation, Lane's kink, abdominal aneurism, rectocele, diseased or displaced neighboring organs, mesenteric disturbances, hernia, cholelithiasis, enterospasm, obstruction by intestinal parasites, procidentia recti, hypertrophy of O'Beirne's sphincter, the rectal valves, levator ani and sphincter mucles, deviated coccyx and rectal affections (hæmorrhoids, ulcers, or fissures).

The above diseases, singly or collectively, lead to the hypersecretion of mucus because they narrow, block, or immobilize the intestine, interrupt peristalsis, induce constipation and fæcal impaction, augment pathogenic bacteria and their toxins, induce inflammatory and ulcerative lesions in the bowel, irritate the mucosa, stimulate the secretory and motor nerves to excessive activity, favor intestinal auto-intoxication, or retain fæces

and discharges until they become offensive and irritating.

Constipation may be congenital or may appear early in life, and nearly always is a complication of mucous colic and membranous colitis; hence, the author believes these conditions are often caused by mechanical intestinal defects which lead to fæcal retention. Under such circumstances, owing to the small amount of food ingested by infants and young children, no trouble ensues in the beginning; but later, when the diet is liberal, and the fæces are more bulky, they pass the obstruction with difficulty, and stagnation takes place and a hypersecretion of mucus ensues.

The writer has observed myxorrhœa coli in a boy of three, in a girl of five, and in six other children under twelve years of age who suffered from post-operative sequelæ where attempts had been made to correct congenital deformities of the colon, rectum, or anus.

In studying the etiology of myxorrhœa coli, one should keep in mind the relation of the colon, to the diaphragm, kidney, liver, stomach, uterus, adnexa, bladder, and prostate, because the bowel is often displaced by neighboring organs or becomes involved through the extension of disease from them.

Splanchnoptosis (enteroptosis, coloptosis, nephroptosis, hepatoptosis, and gastroptosis) is frequently associated with and evidently causes myxorrhœa colica and myxorrhœa membranacea, because stools and colic usually disappear when the organs have been replaced and anchored.

Appendicitis, peritonitis, pericolitis, diverticulitis, abdominal and pelvic suppurations, typhoid fever, and colitis frequently lead to myxorrhœa coli because they favor the formation of exudates, bandular, broad, or encircling adhesions or pseudoperitoneal membranes which agglutinate or bind the gut to neighboring organs or the parieties, twist, angulate, or press upon it causing colonic irritability, fæcal retention, and hypersecretion of mucus.

Three times the author has cured myxorrhœa coli by removing bismuth accumulations from the colon or rectum, and many times he has arrested mucoid evacuations by clearing the gut of scybala and fruit stones, seeds, or skins.

The writer has a record of two hundred patients operated upon for constipation induced by chronic invagination of the sigmoid flexure into the rectum of whom 25 per cent suffered from myxorrhœa colica or myxorrhœa membranacea, and the majority of these sufferers were speedily relieved or cured by sigmoidopexy. The frequency with which women suffer from mucomembranous colitis and the good results which follow the extirpation of uterine tumors, diseased tubes, and ovaries, and the correction of uterine displacements, demonstrates that female genital disturbances may cause myxorrhœa coli.

Vesical and prostatic diseases may also augment the secretion of mucus in some instances by traumatizing the gut or exciting the levator ani muscle to frequent contraction.

In 75 per cent of the cases of myxorrhœa coli treated by the writer, the hypersecretion of mucus was apparently caused by adhesions, angulations, invagination or mechanical bowel defects, inflammatory or ulcerative lesions of the colon or rectum which increased the mucus or caused its retention until it became inspissated and membranous.

In concluding his remarks upon the etiology of myxorrhœa membranacea and myxorrhœa colica, the writer would reiterate that the hypersecretion of mucus is a common manifestation, complicating many chronic medical and surgical diseases of the bowel, and that the amount, consistency, and form of the mucoid evacuations depend largely upon the irritable state of the intestine, enterospasm, shape of the gut where the mucus accumulates, and length of time it is retained.

If internists and gastro-enterologists are aware of these facts, they fail to mention them; consequently, their followers believe that myxorrhœa colica and myxorrhœa membranacea are always induced by intestinal catarrh or neuroses, when they may be caused by many other diseases and conditions.

The *pathology* of myxorrhœa coli is not understood because it is not characterized by definite lesions, seldom kills, and has been studied at autopsy only a few times where it complicated other fatal diseases. The author has observed myxorrhœa membranacea and myxorrhœa colica in patients where the

mucosa was inflamed or ulcerated and where it appeared normal. Most often, however, it has been encountered in individuals who had been suffering from intestinal stasis, fæcal impaction, and toxæmia induced by mechanical defects in the colon or rectum which caused fæcal retention.

Symptoms. Under normal conditions the amount of mucus secreted is so slight that it is difficult to discover in the fæces with the microscope, and when visible in the stools it is being abnormally secreted and the patient suffers from myxorrhœa. The manifestations of myxorrhœa coli are variable in different cases and in the same individual at different times, but obstinate constipation and the periodic evacuation of large quantities of mucus and colic constitute the chief symptoms.

When hypersecretion is marked and mucus is long retained, the water is absorbed and it becomes inspissated, grayish in color, and accumulates in a large mass; or, when compressed, it assumes the form of bowel casts or strips, acts as an irritant, and excites mild peristalsis which favors its expulsion.

Myxorrhœa colica and myxorrhœa membranacea may dominate the disease producing them, and clear jelly-like mucous evacuations may prevail for weeks or months, when suddenly a crisis sets in, the patient complains of cramps, and later of the evacuation of mucomembranous strips or casts. Again, he may suffer indefinitely from mucous discharges induced by a variety of causes and never complain of myxorrhœa colica or myxorrhœa membranacea.

Persons afflicted with myxorrhœa membranacea and myxorrhœa colica are sometimes bothered with impaired digestion, *malaise*, melancholia, nervousness, and abdominal uneasiness, discomfort, soreness, pain or colic for a short while before mucous stools appear, or remain well in the intervals between attacks of myxorrhœa coli.

Strips or casts of mucus occasionally create crawling sensations and are mistaken for worms, but when low down they are easily located through the sigmoidoscope and are to be seen projecting through the rectosigmoidal aperture or hanging over the rectal valves. When mucus becomes dry and collects in any form, it causes irritation and leads to enterospasm (myxorrhœa colica), marked constipation, fæcal impaction, gas distention, and colic, which continue until it is evacuated through the sigmoidoscope or in some other way.

Diarrhœa may be noticeable during attacks of myxorrhœa colica or it may not occur until the obstruction incident to enterospasm has been relieved and the backed-up irritating fæces, scybala, discharge, and toxins find their way into the lower bowel and excite abnormal peristalsis and the hypersecretion of mucus.

Diagnosis. Usually in obstinate cases of myxorrhœa coli the history will show that the patient has been troubled for weeks, months, or years with gastro-intestinal disturbances, menstrual abnormalities, constipation, psychic or nervous phenomena, disturbances of the liver, pancreas, or heart, or obstructing lesions of the gut prior to the attack, which indicate that the mucous discharges are secondary.

Myxorrhœa coli is diagnosed with ease by the mucoid evacuations (made up of jelly-like or mucous strings, strips, or casts) which appear suddenly following attacks of nausea, indigestion, obstinate constipation and abdominal uneasiness, discomfort or soreness in patients who have otherwise been comparatively well.

Myxorrhœa colica must be differentiated from other types of intestinal obstruction; but, in the presence of the enumerated symptoms, violent colic, and the absence of pus or blood in the stools, one is justified in diagnosing this condition before and after the mucous collections have been evacuated. When an acute attack of myxorrhœa coli subsides, the abdomen and intestine should be examined and the fæces analyzed with the object of ascertaining what is causing the hypersecretion and retention of the mucus. It is also important to determine whether or not the sufferer is afflicted with a nervous or other affection which would influence the myxorrhœa colica or myxorrhœa membranacea.

Treatment. A routine treatment of myxorrhœa coli is impracticable owing to its variegated etiology and because the patient may

seek relief from either myxorrhœa membranacea (mucous casts) or myxorrhœa colica (colic). During acute attacks, curative measures should be held in abeyance, for the patient desires immediate relief from the discharge of mucous casts or masses or colic from which he suffers. When the patient seeks a cure the writer informs him that myxorrhœa coli is a manifestation of some other affection, and that, after the crisis is passed, prolonged treatment or an operation may be required to effect a cure.

Where tenacious mucus collects in the lower sigmoid or rectum, it can be removed with a blunt scoop or swab and cotton, following the introduction of the sigmoidoscope; but when higher up, rest in bed, a liberal dose of castor oil, hot-water drinking, abdominal fomentations, and hot high colonic enemata are indicated to soothe the mucosa and cause the intestinal musculature to relax, which in turn overcomes constipation, favors expulsion of the mucus, and relieves the patient mentally and physically.

Strychnia gr.1/60 (0.001), Fowler's solution M 5 (0.30), extract of physostigma gr. ¼ (.015), hypophosphites, Russell's emulsion, and other nerve, muscular, or general tonics are indicated when the sufferer is nervous or run down; and the treatment is more effective when supported by hydrotherapy, abdominal massage, vibration, or electricity when the bowel is sluggish.

Where the bowel is sensitive and highly irritable, and enterospasm is a complication, belladonna M. 10 (0.60) relieves the muscular spasm, but when colic is severe it should be reinforced by codein gr. ½ (0.03) or morphia gr. ¼ (0.016) administered every three or four hours to arrest pain and induce sleep.

Between attacks of myxorrhœa membranacea and myxorrhœa colica, liquid paraffin or albolin, administered in the morning and at night in liberal doses, lubricates the intestine, minimizes constipation, and favors the expulsion of mucus before it becomes inspissated and irritating.

It is advisable in some cases to control the diet, but a routine dietary is impracticable because of the variegated etiology of myxorrhœa coli. During attacks of myxorrhœa colica, better and quicker results are obtained when the patient eats more frequently and consumes chiefly hot fluids, milk, soup, purées, and meat juices, and abstains from foods which leave a large residue.

Following an acute attack of myxorrhœa membranacea, forced feeding and a diet composed mainly of vegetables (cellulose) in conjunction with rest in bed, after the plan of von Noorden, usually corrects constipation, which is followed by cessation of the mucomembranous evacuations and in uncomplicated cases the myxorrhœa does not occur while the patient has normal movements.

A heavy, coarse diet temporarily causes sensations of abdominal fullness and discomfort, but they disappear spontaneously. Where constipation ensues from overdigestion the administration of regulin, pieces of cork, or seeds increases the bulk of the fæces, stimulates peristalsis, and usually brings about normal evacuations.

As soon as myxorrhœa coli and constipation have been relieved, the patient should return to his regular diet and discontinue the regulin. A cellulose or vegetable diet is out of place where the hypersecretion of mucus is augmented or caused by gastrogenic, enterogenic, or neurogenic disturbances, or colitis, because it makes the fæces bulky and irritating to the hypersensitive, inflamed, or ulcerated mucosa, augments the secretion of mucus, and has a tendency toward enterospasm and colic.

Drastic cathartics are contra-indicated during crises of mucous colic because they cannot drive fæces through the blocked gut but increase the patient's suffering. Purgatives also do more harm than good where myxorrhœa membranacea or colica are complicated by chronic intestinal obstruction from whatever cause, since they stimulate violent peristalsis and do not secure the coveted evacuation. Under such circumstances, comfortable stools can be obtained by hot-water drinking and the administration of mineral oil, salts in small repeated doses, fluid extract of cascara sagrada M 15 (1.0 ccm.), or a mild dinner pill to soften the excreta, or belladonna M 10 (0.60) to smoothe and relax the irritable intestinal musculature.

Astringents (tanalbin, tannigen, ichtho-

form, and bismuth subgallate gr. X [0.60]) may be called for in the treatment of myxorrhœa coli complicating colitis when diarrhœa is troublesome, but should be discontinued when the stools become normal.

When myxorrhœa membranacea is associated with inflammatory, ulcerative, or obstructive lesions of the colon, the patients can be quickly improved by treating the mucosa with medicated solutions or oil introduced through the anus or through an appendicostomy or cæcostomy opening, which insures their reaching all parts of the bowel.

Long colon tubes are not dependable for irrigating purposes because they double up in the sigmoid flexure or rectum and prevent the solution or oil from passing into the bowel, causing pain. Medicaments can be made to reach the upper colon by placing the patient in the exaggerated knee-chest posture, introducing the sigmoidoscope, and pouring the irrigant or oil directly into the bowel with the aid of a pitcher and funnel attached to rubber tubing, or by inverting the patient and employing the author's funnel-shaped proctoscope and pitcher, which enable one to pour a quart or more of solution or oil directly into the colon on account of the inflation and displacement of the viscera which ensues.

The author has experimented with many irrigants in myxorrhœa coli alone or complicated by ulceration and diarrhœa, but obtained the best results from boric acid 3 per cent, ichthyol, balsam of Peru and potassium permanganate 1 to 2 per cent, and argyrol 5 per cent irrigations, employed daily or three times weekly. When the mucosa is sensitive and the musculature highly irritable, warm crude oil containing bismuth should be substituted for or alternated with irrigation because of its soothing and healing action. *Surgical Treatment:* When the intestine is obstructed by adhesions, a kink, twist, pericolic membrane, extra bowel pressure or stricture, etc., the lesion must be corrected before a permanent cure can be obtained.

In cases where the colon is permanently disabled, *resection* may be necessary; but when the patient is in poor condition and cannot withstand a prolonged operation, the diseased bowel should be isolated by *entero-anastomosis* or by *unilateral* or *bilateral exclusion*.

Colostomy has been successfully employed in the treatment of myxorrhœa coli, but has been abandoned in favor in appendicostomy, cæcostomy, resection, or intestinal exclusion because of its disgusting features and the serious secondary operation required to close the artificial anus.

The *prognosis* of myxorrhœa membranacea and myxorrhœa colica is very good when caused by obstructing lesions of the colon correctable by operation, but a longer time is required to effect a cure when they are secondary to inflammatory or ulcerative lesions of the mucosa; and myxorrhœa membranacea and myxorrhœa colica are more difficult to eliminate permanently when the hypersecretion of mucus is induced by gastrogenic, enterogenic, or neurogenic disturbances, general disease, or atonic constipation.

UTERINE SARCOMA

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WHILE primary sarcoma of the female genitalia is not common, it is, however, not infrequently met with, and this applies particularly to sarcoma found in the ovaries. Sarcoma of the vulva is very rare (1), usually melanotic in type, and, as elsewhere, metastasizes early. In the vagina, sarcoma is less common than primary carcinoma, which is rare in this location. Its presence here has been noted congenitally and in women up to eighty-two years of age. However, 75 per cent of the cases occur in children under fifteen years, and in these cases the growth is of a dull red or chocolate brown color, circumscribed and polypoid in form. In adults it occurs as a diffuse infiltration or as a rounded sessile growth prone to ulcerate.

In this paper we are particularly concerned with primary sarcoma of the uterus. In 1860, C. Mayer first described uterine sarcoma, stating that the growth was a sarcomatous polyp. This was confirmed by Virchow. In 1867, G. Veit first described sarcoma of the cervix.

Anatomically, uterine sarcomata may be divided into those originating in the cervix or the fundus. Histologically, those occurring in the fundus arise either from endometrium, from the uterine wall, or from a myoma. In both uterine wall and myoma the process may start either in the fibrous connective tissue or in the muscle tissue. When originating in a myoma they have been designated by Williams (2) as myosarcoma and myoma sarcomatodes depending upon whether they originate in the connective tissue or in the muscle respectively. In these cases, however, both muscle and connective tissue are usually ultimately involved. In the cervix they originate either in the connective tissue, in muscle, or in a fibroid as in the fundus.

Sarcomata of the uterus, as elsewhere in the body, are divided into large and small, round- or spindle-cell varieties, although the types frequently more or less overlap. The sarcomata of blood and lymph vessels, the perithelial angiosarcomata, which arise from connective tissue, and the endothelioma of these vessels, which are cytologically a cross between carcinoma and sarcoma, are finer histological differentiations which we will not separately discuss. Melanotic sarcomata are never primary in the uterus, though secondary growths have been reported.

Two-thirds of the number of women with uterine sarcoma are below the average in child-bearing, have not reached puberty, or have not borne children for a long time. According to Montgomery (3), Weir (4), Williams (5), and others, sarcoma of the body is more common than sarcoma of the cervix, though Fisher holds the opposite opinion.

Sarcoma of the cervix occurs, usually, either before twenty or after the menopause. There are three fairly defined types: First, the grapelike, cystic, or racemose variety, first described by Spiegelberg in 1879, consisting of masses of nodules or vesicles projecting from the cervix. These nodules are oval or rounded in shape, one to two centimeters in length, and translucent or bluish and hæmorrhagic in appearance, resembling closely the substance of a hydatid mole. They contain a thick, sticky, clear or turbid fluid. Microscopically, these cysts are covered by a single layer of cylindrical epithelium; within, they consist of larger rounded or spindle-cells separated by clear spaces which are traversed by fine fibrous threads. With this type the progress is slow: they are reluctant to invade and only occasionally or at a late stage do they invade the muscularis, which uusally shows a reduced vascularity.

The second type, the solid polypoid or nodular sarcomatous tumors of the cervix, are soft, yellowish, or pink in color; the surface is smooth and glistening in the absence of necrosis, which is rather late to occur.

There remains a third type, the diffuse in-

filtrative form which macroscopically is impossible and microscopically often is difficult to differentiate from carcinoma.

Sarcomata of the endometrium, the most common type of uterine sarcoma, constituting about one-third of all cases, occurs relatively early in life and more frequently in nullipara when compared with carcinoma. Here they occur in diffuse or rounded lobulated forms, more frequently the latter. The edges are sharply demarcated and without encapsulation. The surface is smooth and glistening, unless ulcerated, which is not an early finding. The substance is soft, often brainlike, yellow white or pinkish in color, and is early covered with intact epithelium. As a rule, the glands are destroyed, but they may be either normal or hypertrophied, and they have been found to be the seat of a coexisting carcinoma. When cut into, the tissue presents a smooth, homogeneous, glistening appearance, rarely traversed by broad trabeculæ as in adenocarcinoma. The uterine wall usually is not invaded early, and this makes this type one of the most favorable for treatment.

Sarcomata of the wall occur either in the myometrium (mural), or more often in a fibroid, and in either case they are rarely if ever seen in the young. Mural sarcoma form single or multiple nodules varying in size, rarely a diffuse infiltration. They tend to work toward the uterine cavity and form polyps. They may remain latent for a considerable period; and they metastasize more slowly than a carcinoma but more rapidly than cervical sarcoma, the points of predilection being lungs, liver, and intestines.

A great deal has been written concerning the occurrence of sarcomatous changes in fibroids, and the opinions vary considerably. Winter and Ruge (6) found sarcomatous changes in 2 per cent of subserous, in 4.5 per cent of interstitial, and in 9 per cent of submucous fibroids. Noble claims that 2 per cent of all fibroids show malignant changes. Klein, in 491 operations for myomata, found that 2.6 per cent showed sarcoma and 5 per cent were accompanied by carcinoma, 3.2 per cent of the fundus and 1.8 per cent of the cervix. Mackenrodt (7) found carcinoma in 6 per cent of his fibroid uteri, and 1.7 per cent of the fibroids were sarcomatous. The most extensive recent figures, collected by Miller (8), show that from 9,750 consecutive cases by twenty-six operators the percentage of sarcomata found in myomata vary from none at all to 6 per cent, and average 1.96 or 2 per cent.

Fibromata of the uterus are prone to so many degenerative changes that, with exceptions, a sarcomatous transformation in a myoma is difficult of gross diagnosis. Metastases visible at operation or suspected from clinical symptoms are very important. The fibroid in which the malignancy is imposed is, as a rule, softer than the usual non-degenerating tumors of this type; it is also darker and more congested.

On section, the sarcomatous tissue is softer as a rule, more yellowish white in color, and has less stroma than the firm, glistening white, fibrous surface of a cut fibroid. The margin of the malignant growth is rarely sharply defined and varies in its regularity. No encapsulation is to be made out. The cut surface usually shows small irregular yellowish areas of necrosis and limited areas of interstitial hæmorrhage. There may be cystic areas from dilated lymph spaces or liquefaction of necrotic foci. The tumor tissue is in close contact with the blood spaces with extension along the large vessels.

Symptoms. The symptoms of uterine sarcoma are not definite. In general, they are those of carcinoma. A watery or blood-tinged vaginal discharge, bleeding, menorrhagia, or metrorrhagia are the first signs in one-half the cases. Menorrhagia during the menopause; pain in the tumor independent of menstruation; and an abundant, thin, watery discharge after the menopause which does not lessen with the progress of the disease, all are common symptoms of sarcoma of the uterus. The uterus is softer and less resistant; it increases in size more rapidly and to a greater degree than with carcinoma. Pain is a more prominent symptom with sarcoma. There is possibly more profuse bleeding and less breaking down than with carcinoma. Metastases are less common (one-quarter of all cases), and occur later than with car-

cinoma. Uterine tumors, congenital or before puberty, excluding those produced by embryonal defects, are most frequently sarcomata. Sarcoma is also relatively more common after, than during, menstrual life.

Should a uterus containing fibroids increase in size more rapidly than is explained by the fibroids, excluding pregnancy, sarcoma should be suspected. Increase in size after the menopause should always suggest sarcoma.

Etiology. The etiology is as yet a secret which science has not learned. When discovered, it may be the same, or one closely allied to, the factor that causes carcinoma, the discovery of which is to-day our greatest medical problem. That the etiological factor of sarcoma will differ, in some respects at least, from that of carcinoma seems reasonable, since the two malignancies, although frequently affecting the same organs, do so in different proportions, at different periods of life, under non-similar circumstances, and originate in different tissues.

Microscopic study. The final diagnosis of sarcoma of the uterus almost always rests on the microscopic picture and even then is frequently difficult. Heretofore, the personal equation has been even more important than at present; but as we are getting better and more uniform pathologists and surgeon-pathologists, our diagnoses and statistics are becoming more uniform.

As stated above, uterine sarcomata fall into round, or spindle-cell varieties and are of small or large cell types. There is often no sharp line of demarcation between the large and small cell types, as these, as well as the two varieties (less marked the latter), are sometimes considerably overlapped. The growths consist of a rounded or slightly irregular homogeneous mass of cells with but little intervening tissue, and they are rarely encapsulated. In general, the sarcoma-cell is of an embryonal type arrested at an immature indifferent stage of its development. The cells show greater individuality, with variations in size, shape, and nuclear chromatin; and it is only when these characteristics and variations are present that we are justified in diagnosing sarcoma.

The tissue cells in which the sarcoma occurs show a hyperplasia, also a heteroplasia or a change from the usual type. They show variations in size, with large and small cells seen side by side. The nuclei are relatively large, often as large as the original connective-tissue cell, and are irregular in outline; they stain with more or less irregularity and frequently show mitotic figures as well as evidence of direct division.

The preponderance of cellular constituents over the ground substance, the reverse of mature connective tissue, is characteristic of sarcoma. Connective-tissue fibers are seen permeating the cell masses and often lying between individual cells, a feature never seen in carcinoma. The blood supply is good, as a rule; if not sufficient, degeneration occurs. New blood spaces are formed, lined with but a single layer of endothelium in direct contact with the tumor-cells, whereas in carcinoma there is always more or less connective tissue intervening between endothelium and tumor tissue. It is not uncommon to find blood spaces choked with tumor-cells, showing beautifully the process of metastasis by the blood stream.

In the spindle-cell variety the nuclei stain more irregularly than in the round-cell variety, the smaller nuclei staining the deeper. The nucleus is relatively larger and more completely fills out the tumor-cell, the edges of which are more rounded than those of the connective-tissue cell. The cell-bodies may be quite closely packed or may be separated by a homogeneous ground substance which is traversed by the fine connective tissue.

The round-cell variety shows masses of homogeneous cells with or without areas of limited and localized necroses and but little stroma. The cells have round or oval vesicular nuclei of uniform size. Many fine blood-vessels and a fine connective-tissue stroma divide the tissue into alveoli. Necrosis is usually marginal, and here the connective-tissue stroma can be seen uniting with the peripheral connective tissue. In this variety, especially in the large round-cell type, there may be a marked cordlike arrangement of cells showing transitional forms, sharply distinct from the rest of the tissues and having

a loose arrangement simulating epithelium and therefore carcinoma. These cords in section appear as rounded or polygonal cell-nests, giving an alveolar appearance so common in carcinoma; but close observation will show a fine network of connective tissue in close approximation with the cells traversing these nests and uniting with the connective tissue of the stroma at the periphery.

In fibroids undergoing degeneration, to distinguish a sarcomatous transformation is sometimes difficult. However, when only degenerative changes are present, the elements represent fully formed, mature tissue, and the individual kinds of cells are uniform in shape, size, staining, and so on.

Treatment. Whenever sarcoma of the uterus is diagnosed positively from curettings, or is strongly suspected after careful consideration of all diagnostic factors, as complete a hysterectomy as is possible should be done immediately, identical to that done for carcinoma.

If sarcoma is diagnosed as early as carcinoma the results should be more satisfactory than with the latter condition, since metastasis is slower and at a later stage of the disease. Miller states that of 180 cases impartially chosen from the literature, 12.7 per cent were free from recurrence after one year or more. Eighty-one cases died from the operation and recurrence, and 76 cases were not followed; excluding these, there were unfavorable results in 79 per cent.

Fibromata are often removed solely for fear that they may become the seat of sarcoma. At present this is not justified, since Miller's figures show that 6,646 consecutive radical myomectomies by twenty-two operators were accompanied by a mortality of 4.87 per cent, whereas not more than 2 per cent of myomata become the seat of sarcomata. Promiscuous myomectomy is especially unjustified since we are learning what favorable results may be obtained by the judicial employment of the X-ray. If hysterectomy always be done in suitable cases, operative procedure is more justifiable, since a certain proportion of myomatous uteri which do not become sarcomatous develop carcinoma. In the hands of competent operators panhysterectomy should always be done for myomata in women near or past the menopause who require operation, or the mistake described in one of the following cases will be made.

The following two cases of sarcoma of the uterus I have seen and wish to report in more or less detail.

CASE 1. Gyn. No. 5,243. Mrs. R., 48 years of age; married 29 years; III-para; youngest child 17 years old.

Complaint. She had had backache with pain in her left side for seven or eight years; metrorrhagia for the past four months; menorrhagia for the past four years; a heavy dragging sensation in the lower abdomen and pelvis.

Family and past history. Unimportant.

Menstrual history. Menstruation began at 11, formerly every four weeks, but had been irregular for the past four years; formerly four to five days' duration, now eight to ten days. Last period four months previous to admission; bleeding for fifteen or twenty days.

Present illness. For the past four years her periods had been irregular and increasing in amount, lasting eight to ten days instead of four to five days. Seven months prior to admission she had had a uterine hæmorrhage lasting for several days. One month later she had a similar hæmorrhage, though less severe. Three months later she had a similar hæmorrhage, except at this last time the discharge had had some odor. She was then curetted and had no subsequent bleeding. These hæmorrhages did not coincide with time for menstrual periods.

Physical examination was unimportant except that the pelvic examination showed a relaxed vaginal outlet, the external os was patulous, and the uterus was enlarged to the size of a fist and irregular in outline. Both tubes and ovaries were slightly enlarged and adherent. White blood-corpuscles, 8,000; hæmoglobin, 85 per cent. Urine showed a trace of albumin, but no casts.

Operation. Supravaginal amputation of the fundus uteri, bilateral salpingectomy, right oöphorectomy, appendectomy, and separation of adhesions. The abdomen was opened in the midline below the umbilicus; the adherent tubes and ovaries were separated and removed with the fundus, which showed several myomatous nodules. Peritoneum was stitched over the raw areas. The appendix was adherent and was removed. There was no glandular enlargement; the gall-bladder was normal. The abdomen was closed in layers. The patient's recovery was uninterrupted except for a slight infection of the abdominal wound. She left the hospital on the thirty-fourth day in good condition.

Pathological report. Gyn. Path. No. 4,275. *Specimens:* uterus, both tubes, right ovary and appendix.

The uterus, Fig. A, was enlarged, measuring 8 x 8 x 7 cm. It was smooth and firm, and had no

irregularities on its surface, though a firmer area was felt in the middle of the anterior wall. It was opened by splitting the anterior wall, which was 3 cm. in thickness. The endometrium was thin, smooth, and anæmic. On the posterior wall were a few slightly raised areas of pale, glistening, yellowish white tissue, which were rather firm and over which the endometrium was intact (1, 1, Fig. A). Situated in the anterior wall and represented at 3, 3, 3, Fig. A, was a tumor the size of an olive which was firm, non-encapsulated, and though rich in cellular elements which were easily scraped away, had a fibrous connective-tissue stroma. The growth was of a grayish yellow color with a few small areas of deeper yellow which were probably areas of necrosis. The growth was ill-defined and spread irregularly out into the thickened muscular wall, and continuity could be traced to the areas seen at 1, Fig. A, which were therefore tumor tissue.

The tubes measured 8 cm. in length and 0.8 cm. in diameter. Their surface was ragged and congested, the peritoneum torn, lumen patent, fimbriated end open. No nodules were felt.

The right ovary measured 3 x 1.5 x 1 cm. The surface was roughened, though regular in outline and covered with fine adhesions. No cysts or palpable nodules were present. The consistency was normal. Hardened intact.

Microscopical examination. Uterus: The uterine wall, Fig. B, from area 2, Fig. A, which is characteristic of all areas, shows a slightly swollen musculature (1, Fig. B), more or less densely invaded by a new-growth. Areas showing the greatest invasion are almost void of uterine musculature, and the invading cells present are in clumps or columns or strands, varying from one to seven or eight cells in thickness (2, Fig. B). More or less connective tissue is seen in every direction, ramifying between the columns of cells and even between the individual cells, which is so common in sarcoma. There is absolutely no semblance of encapsulation or circumscription, the growth seemingly running wild. The

Fig. A. 1,1, growth presenting in uterine cavity; 2, 3, 3, 3, tumor in uterine wall; 4, site of amputation.

vascularity is not marked and seems even less than normal, though no necrotic areas are seen microscopically. There is a more or less dense infiltration with small round-cells and a few leucocytes, especially where the invasion is the more marked.

Further out in the musculature (Fig. C) the malignant cells are seen in much larger columns or bundles or nests in immediate contact with the muscle fibers (1, Fig. C), or plugging endothelial lined spaces some of which are blood-vessels, as the external coats are readily distinguished (2, Fig. C), and others are lymphatics, thus proving beyond question the possibility of metastases by either blood or lymph channels. The centers of these outlying nests occasionally show some cellular infiltration with moderate necrosis in their centers (3, Fig.C). The outline of the individual cells, being compact,

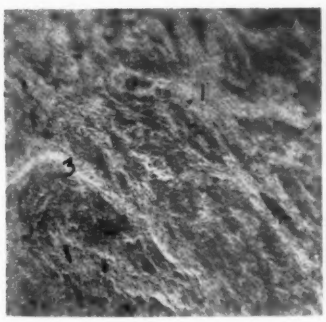

Fig. B. From 2, Fig. A. 1, 1, uterine muscle; 2, 2, 2, clumps and columns of cells; 3, blood-vessel.

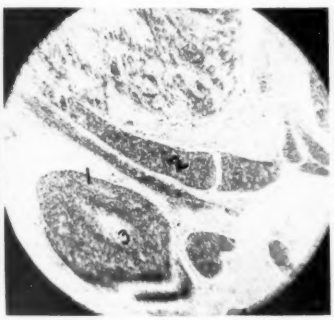

Fig. C. 1, cell-nest in contact with muscle-fibers; 2, vessel plugged with tumor-cells; 3, necrosis in cell-nest.

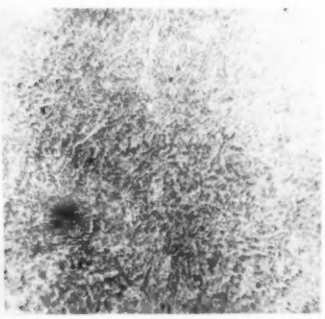

Fig. D. Less stroma than in Fig. B; note larger, more irregularly staining nuclei than in preceding figures; more marked round-cell infiltration.

Fig. E. 1, fibroid nodule; 2, area over fibroid; 3, tumor growth in uterine cavity.

is not seen, except where more or less widely separated. Here they are slightly irregular, light staining with eosin, and are two to three times the size of the nucleus. The nuclei are rounded, oval, or slightly irregular, and, though varying somewhat, are more or less regular in size and average about twice the size of a leucocyte. The nuclei stain quite uniformly and only moderately deep. Fine granular chromatin, more or less clumped in some, is easily made out in the nuclei.

Occasionally mitotic figures are seen, but the cells undergoing direct division are the predominant type of cell multiplication. These dividing cells are swollen and with their several nuclei constitute giant-cells.

The division and separation of the malignant cells by the muscle and fibrous tissue trabeculæ, which are so marked generally and made out though faintly even in the outlying nests, some of which have a lobulated alveolar appearance; this feature, with the previously-mentioned characteristics, seems to justify a diagnosis of sarcoma.

A section at 4, Fig. A, at the site of amputation, shows cell-nests in the muscle which unfortunately make recurrence inevitable even though metastases had not already taken place.

Right ovary: One block (Fig. D) shows an almost solid mass of malignant cells, there being present but a narrow strip of ovarian capsule and no cortex whatever. The cells are more massed and there is relatively less connective tissue than in the uterine growth, as here no marked trabeculæ are seen. The connective tissue present is fine and ramifies between the individual cells. Here, to only a modified degree compared to the uterine growth, are the strands and columns of cells present.

The cells themselves vary considerably from those seen in the uterine growth. But few cell-bodies are distinguished and the nuclei are very much larger and more irregular in shape, being elongated, oval, and of many irregular shapes. Though the nuclei stain vesicularly as a rule, many deep and irregularly stained ones are seen. The chromatin is coarser and more granular, and both direct and indirect divisions are much more in evidence than in the uterine growth. The round-cell infiltration is marked. A section from another area shows small nests of cells similar to those just described, but with abundant connective tissue surrounding them.

These growths are no doubt the same as that seen in the uterus and are metastases from that source, the growths being so small as to have been undetected in a normal-sized ovary until sectioned. The larger, more rapidly proliferating cells are probably due to a better blood supply in the ovary than in the uterine wall.

Right tube: The walls are somewhat thickened and their surfaces show evidence of adhesions. In the wall there is a small group of cells distinctly foreign to the surrounding tissues; they are densely packed in the connective tissue, which does not seem to enter the mass. The cell-bodies are but very indistinctly made out, though they seem to be somewhat spindle-shaped. The nuclei are uniform in size, being about twice the size of a leucocyte, rounded or oval in outline, staining vesicularly and uniformly, and possess a very fine granular chromatin which in places is grouped in large granules and is very deep staining. This is considered an early metastasis.

Left tube: Like the right tube, but without evidence of metastasis.

The appendix shows a chronic inflammatory condition at the base and obliteration of the lumen at the distal end.

Diagnosis. Large round-cell sarcoma (alveolar type) of the uterine wall with metastases to the right tube and ovary.

CASE 2 Gyn. No. 5,122. Mrs. L., 53 years of age; a widow for 15 years; had been married 34 years ago, I-para 27 years ago.

Complaint. Pain over the entire lower abdomen and in back; also a thin, watery, occasionally bloody vaginal discharge.

Family and past history. Unimportant except that for twenty years she had had frequent attacks of weakness and exhaustion with anæmia which always yielded to treatment.

Menstrual history. Menopause several years previous.

Present illness. Dated back about one year, at which time she first noticed a thin watery discharge which gradually increased in amount and recently was frequently blood-tinged. Five weeks before admission she was seen and a large symmetrical softened uterus made out, with more or less necrotic material, which was taken for a sloughing fibroid, projecting from the cervix. This was cleaned out

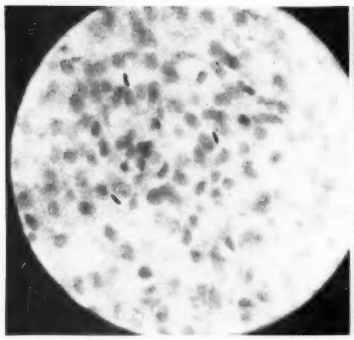

Fig. F. Solid mass of tumor-cells with no connective tissue between. Irregularity in size and staining noted in nuclei. 1, dividing cells. Leitz, ocular 4, objective 6.

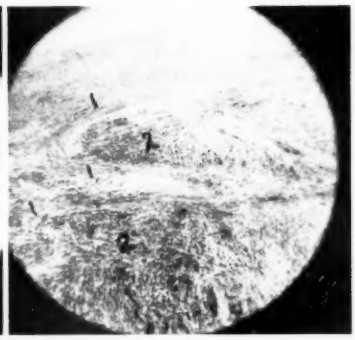

Fig. G. 1, 1, 1, uterine muscle in immediate contact with tumor tissue; 2, 2, tumor tissue.

by curettage and sections of the tissue looked like atypical decidual tissue which was thought to belong to one of the uterine moles. Since then the uterus had again filled up with the growth which was now considered unquestionably malignant. The patient was complaining of considerable abdominal pain and progressive anæmia.

Physical examination showed a thin, markedly anæmic woman in no apparent discomfort; otherwise negative, except for her abdomen, which was symmetrical and tympanitic except for an area in the midline from just below the umbilicus to the symphysis and extending 6 cm. on either side of the midline, where the note was dulled. Pressure here was painful and a rather firm, globular, irregular tumor, which was movable, was made out. Kidneys were not felt; liver normal size; inguinal glands not palpable. The pelvic examination showed the outlet to be in good condition; the vagina contained some bloody discharge with shreds of necrotic tissue; protruding from the cervix was a friable mass of necrotic tissue which on breaking away was found slightly fibrous and very congested, though places showed a whitish brainlike substance, also places resembling necrotic placenta with a musty mouldy odor; the cervix was thinned out and dilated to admit one finger, which palpated a mass attached to the left of the fundus; the uterus was regularly enlarged, globular or oval in outline, movable, and extended up nearly to the umbilicus. Tubes and ovaries were small and freely movable.

Operation. Dilatation, curettage, and packing of the uterus, abdominal panhysterectomy, bilateral salpingo-oöphorectomy, appendectomy. After emptying the uterus of its contents and packing with formalin gauze, the abdomen was scrubbed and opened in the midline below the umbilicus. The uterus was now the size of a large orange and free. The tubes and ovaries appeared normal and were removed with the fundus and cervix and a large amount of parametrium, though the latter showed no thickening and the lymphatics apparently were not involved. An adherent appendix was then removed. Drainage was established through the vagina and the abdomen closed in layers. Convalescence was complicated by a phlebitis. A month after operation a recurrence was scraped away from the vaginal vault. The patient left the hospital 42 days after operation in fair condition but died several months later, probably from metastases.

Pathological report. Gyn. Path. No. 4,171½. *Specimens:* Entire uterus, both tubes and ovaries, appendix.

The uterus (Fig. E) measured 12 x 6 x 8 cm. Its surface was smooth and glistening, regular in outline except for a small pedunculated myoma at the right cornu (1, Fig. E), and one the size of a hen's egg buried in the right posterior uterine wall. On opening through the anterior wall, an area 6 x 4 cm., the center of which was the left cornu, was seen roughened by many villous tags up to three centimeters in length (3, Fig. E). These tags were yellowish and somewhat more hæmorrhagic than the rest of the uterine canal from which the endometrium had been curetted. The uterine wall was about 2 cm. thick, except over the area where the growth was attached, where it was 4 cm. in thickness. The wall was invaded by the growth to a depth of 0.5 cm. The walls of the cervix were thinned out and about 0.5 cm. thick at the external os.

Tubes and ovaries: The tubes measured 8 cm. in length and 3 to 4 mm. in thickness; the ovaries 3 x 1 x 1.5 cm. All were apparently normal.

Microscopical examination. Sections through the tissue attached to the uterine wall show a homogeneous mass of nuclei (Fig. F), which vary considerably in size, the smaller being about four times the size of a leucocyte and the larger three to four times the size of the smaller. They are oval, rounded, or slightly irregular in outline. The nucleus almost always shows up well. Here and there beautiful mitotic figures are seen as well as nuclei dividing by

direct division (1, Fig. F). The nuclei stain irregularly, from light vesicular to deep blue. The cell-bodies cannot be well made out, but seem compressed and irregular; in other areas where not so compact they are slightly spindle-shaped and here the nuclei are slightly elongated. Between the cells no connective tissue is made out. Some blood-vessels are seen, but they do not seem excessive or dilated. Here and there are seen areas of pus-cell infiltration.

Uterine wall: Some sections from the uterine wall in the neighborhood of the growth, macroscopically not involved, show microscopically a musculature only slightly infiltrated with small round-cells and an atrophic normal endometrium. However, where by the naked eye the wall was seen involved, the malignant condition is quite beautifully shown microscopically (Fig. G). The cells, however, seem to be more spindle-shaped than in the loose uterine growth, and some slight amount of connective tissue is seen in the strands and bundles of invading cells. These strands and bundles extend but a very short distance into the musculature; indeed, they are quite superficial. They come into immediate contact with the muscle-cells (1, Fig. G), having no law or order in their progression and appearing as if they might be eroding the muscle wall. When they meet muscle-fibers perpendicularly they seem to encounter less resistance and invade deeper than when they attack the fibers at right angles. Numerous capillaries in direct contact with malignant tissue are seen. The uterine wall in the immediate neighborhood of the malignant involvement shows considerable vascular increase, congestion, and round-cell infiltration.

Ovaries: Both ovaries are sclerotic. In the parametrium, seen in section of the left ovary, there is a definite metastasis, the cells appearing quite like those described invading the uterine wall.

Cervix: No glands are seen nor is any malignant involvement made out. The musculature and fibrous tissue is slightly swollen and stains deeply.

Diagnosis. Large round-cell sarcoma of the endometrium.

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DACTYLOCOSTAL (OSSEOUS AND CARTILAGINOUS) RHINOPLASTY[1]

By EDWARD G. BLAIR, M. D., Kansas City, Missouri

THE term rhinoplasty is here used in its most comprehensive sense and includes restoration from the three gross deformities that are common in the nose: *first*, entire absence of any external nasal tissue and septum; *second*, preservation of the skin and cartilages covering the nose but collapsed from the entire loss of septum and columna; and, *third*, from loss of upper lateral cartilages and partial loss of the septal cartilage and nasal bones — the very common "saddle nose." The procedures which are here offered for the correction of these deformities are to some considerable extent susceptible to interchange under modification and the methods applicable to all the minor defects in the nose.

In the correction of the condition where entire loss of nose exists, these essentials must be attained: an integument, practically free from scar, covering the half of a pyramid diagonally sectioned and projected from the face, with two openings in its base for nostrils and with a septum. If these features exist, it is surprising how little or how much passes for a nose. It is unnecessary to refer to the ancient methods of the French, Italian, and Hindu schools except to say that none of those operators produced even the first requisite.

In 1886, beginning with König, the German surgeons began the use of osteoperiostitic flaps for projection, but these were lacking in the other essentials and for the most part were unwieldy.

The method here presented for the total absence of a nose embraces the use of a finger, out of which the essentials are first constructed before attachment to the face. The ring finger of the left hand is selected,

[1] Presented before the Medical Society of the Missouri Valley, March 27, 1914; and before the Jackson County (Missouri) Medical Society April 28, 1914, with exhibition of cases.

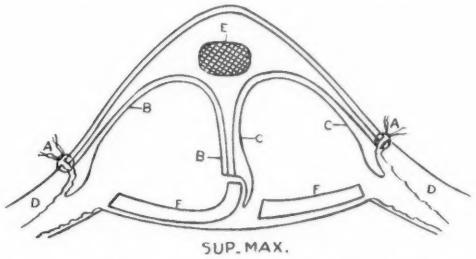

Fig. 1. A-A, widened dorsum of finger; B-B, skin of chest-wall lining; C-C, Thiersch graft lining; D-D, lifted facial tissues; E, bone of finger; F-F, tissue covering nasal floor.

split throughout its entire length on the anterior surface, and cross-sectioned at the proximal flexion through the tendons down to the bone. The skin and subcutaneous tissue of one side is laterally dissected well around to the dorsum; a similar dissection of the other side carries with it all the tendinous tissue, leaving the front of the phalanges bare of soft tissue and the finger trebled in dorsal width, to maintain which the margins are sutured to a plate of celluloid applied on the back. The distal joint is excised for ankylosis. To further maintain this width and furnish the foundation of the septum, a flap of skin and subcutaneous tissue is turned back from the chest wall, as was done by Baldwin[1], larger in dimensions than the split surface of the finger, and left attached; up to this attachment the opening is immediately sutured. The finger is now brought into contact with the chest flap, raw surfaces together and sutured at the margins. This position is kept for one week by adhesive slings, at the end of which time section of the flap from the chest is made under local anæsthesia, and its amalgamation with the widened finger is allowed to grow to the state of perfection. When this is reached, the half of the finger carrying the tendons is again split from the margin to and beyond the median line throughout its length in a flat plane and beneath the tendons. This flap then is flatly turned over on its other half as the leaf of a book, exposing the double raw surface, over which one Thiersch skin-graft is immediately applied. When this has healed, a free comb of tissue projects from the middle of the finger — made up on one side of chest-wall flap, on the other of Thiersch graft with tendinous and subcutaneous tissue in between.

As soon as these newly fashioned tissues become pliable, and before too much shrinkage occurs, the finger is applied to the face in the following manner: The margin of the facial opening is incised throughout its entire circumference well inside the nasal cavity. The contiguous soft tissue on the cheeks is freely lifted with a periosteal elevator and is carried well up to the frontal bone above. A small flap is now turned up from the floor of the nasal cavity and left attached at the median line; a similar flap is sought in any available tissue inside the cavity above. In the finger, the nail and dorsal tissues are removed back to the distal knuckle and the bone made bare; the margins are freshened by turning a small Lane flap from above downwards as far in length as the middle knuckle, the flaps slipped under raw edges of the facial tissue with the integumental

[1] Surg., Gynec. & Obst., 1912, xv, 720.

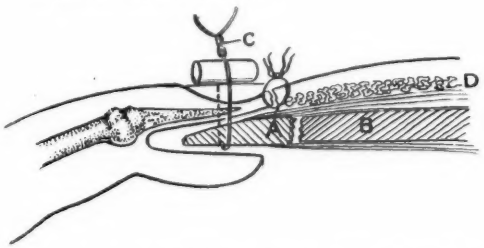

Fig. 2. A, rib-cartilage; B, rib; C, silver wire anchorage into jaws of split finger; D, chest-wall integument.

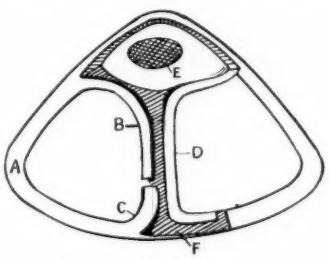

Fig. 3. A, complete nasal integument; B, flap turned from inside nose; C, flap turned up from floor of nasal cavity; D, dorsal flap of skin turned down from finger; E, bone of finger; F, granulating surfaces unexposed.

Photograph 1.

Photograph 2.

Photograph 3.

Group 1.

Group 1 is a case in which there is an entire absence of a nose (Photograph 1), even to the extent of partial destruction of the nasal bones and vomer with marked retraction of the contiguous tissue of the face into the nasal opening, a condition doubtless due to hereditary syphilis. Our procedure was to supply this defect by splitting the two distal phalanges of the ring finger and suturing them to a celluloid plate applied to the dorsum (Photograph 2), then applying this to a flap of skin turned back from the chest-wall (Photograph 3), and after seven days detaching; subsequently splitting this tissue thus obtained longitudinally to the middle of the finger, turning this over and applying a large Thiersch skin-graft, thus making a comb of soft tissue, the beginning of a septum (Photograph 4); then removing the nail, the distal joint already having been stiffened, and suturing the finger to the freshened edges of the facial tissue, holding it in place by a fixed plaster cast (Photograph 5). After nineteen days amputation of the finger from the hand was performed; the proximal phalanx was split and set into the superior maxillary bone at right angle to the portion sutured to the face to form the base of the nose. Through slits of the split phalanx rubber tubes were inserted to maintain the nostrils (Photograph 6). Through a failure to observe properly the interference to the circulation brought about by this angular flexion of the knuckle most of the proximal phalanx sloughed, leaving a fair nose, as indicated in Photograph 7, with small contracted nostrils which might be considered a reasonably satisfactory result, but which was not satisfactory to us, who hoped for something better. To correct this deficiency, then, on November 7, 1913, the end of a cartilage of a rib was turned up and sutured to the split first phalanx of the middle finger. After ten days one and one-half inches of this rib and cartilage with thoracic skin and muscle covering was detached and allowed to thoroughly establish a circulation from the finger, as shown in Photograph 8; subsequently, the nose already obtained was split longitudinally and the wings turned back, exposing the bone of our former finger; over this then was superimposed the rib still carried by the finger and sutured to the wings which had been turned back. Ten days later the rib was amputated from the finger and the finger restored, the rib having splendid circulation supplied by its attachment to facial tissues. Photograph 9 shows result of rib-grafting. February 16, 1914, after section from finger.

surface toward the nostril. Similarly freshened margins are made on the finger comb to be attached to the nasal flaps above and below. The bare unguinal phalanx is now passed under the edges of the soft tissues above and anchored by a suture passed through them and the phalanx and tied over a piece of gum tubing. The marginal face and finger tissues are sutured with simple interrupted sutures of silk. A cross-section of these assembled tissues is seen in Fig. 1.

The finger is held in contact with the face as illustrated in a plaster cast. The length of time it should be kept so is not determined by days, but, after five days, by tourniqueting the finger with a small rubber band, shutting the blood supply from the hand, and observing the circulation from the face. The opinion is now well established that this procedure

Photograph 4.

Photograph 5.

Photograph 6.

Group 1. For description see legend under Photographs 1, 2, and 3.

done each day for from fifteen to thirty minutes under inspection stimulates the establishment of the facio-finger circulation and reduces the length of time in the cast. In the original case amputation was made in nineteen days; but it was recognized that it could have been separated in fourteen. Another physiological observation worthy of note is that at the end of ten days the patient voluntarily said, "My finger down to there (meaning the middle knuckle) feels like my nose, the rest of it like my finger."

When the circulation is thoroughly established from the face, amputation is done at the metocarpophalangeal articulation, and the projecting phalanx is reflected backward so that the middle articulation can be removed with a rongeur to ease the tension in the dorsal tissues and prevent the ischemia resulting from extreme flexion of this phalanx when it is set into the tissues covering the superior maxilla to secure projection. Before this is done the soft tissues of the phalanx are slit on each side close to the bone and

Photograph 7.

Photograph 8.

Photograph 9.

Group 1. For description see legend under Photographs 1, 2, and 3.

Photograph 1.

Photograph 2.

Photograph 3.

Group 2. Photograph 1. Collapse of nose due to entire loss of septum, part of vomer and superior lateral cartilages; March 28, 1913; German Hospital, Kansas City, Missouri.

Group 2. Photograph 2. Front view of result obtained by using finger according to technique described; July 9, 1913.

Group 2. Photograph 3. Side view of same; July 9, 1913.

carried to the face for suturing. The middle portion is set into a transverse incision made into the maxillary tissues down to bone and sutured in place. Freshened edges of the septal tissue are made and brought into contact as the flexion is made. There are now no raw surfaces exposed except the margins of the slits, and into these gum tubes are placed to allow for healing and formation of the nostrils.

If for any reason there is insufficient projection, or if from contraction more tissue is desired, the following plan may be utilized successfully: A flap of chest wall is again used similar in shape to that used before, but made over a rib including its cartilage and all the tissues down to the pleura; the cartilage of the rib is sectioned and the free end in the flap turned up. The soft tissues of the middle finger of the left hand are now split in a flat plane anterior to the bony phalanx back to the distal flexion. Into the jaws of this incision the projecting rib cartilage is set and anchored by a silver wire inserted along one side of the nail inward and through the cartilage and out again on the other side, the ends being twisted over a piece of tubing placed over the nail. The skin of the upper jaw of the finger is sutured to the free end of the skin of the chest wall, and contact of the lower finger flap is made by the introduction of packing introduced to elevate the rib and prevent its reunion. After ten days, section of the rib-flap was completed one and one-half inches away from the point of finger contact. In this way the finger was made the carrier of chest wall, including skin, rib and cartilage (Fig. 2), one and one-half inches in length by one inch in width. This union was continued with the hand free on a simple splint until the vitalization and formation of the graft was what was desired. Three weeks' time was given to this, with only slight shrinkage. The former finger nose was then split in the median line from a point above desired to the tip, down to the bone, and the nasal covering dissected off laterally, making two wings of soft tissue — former dorsum of the finger. Perfectly healthy bone and septum were revealed, but were somewhat retracted. The margins of the chest-wall graft were freshened, as were those of the widened finger, and this tissue was superimposed on the exposed bone, with which its freshened, granulating

Photograph 1.

Photograph 2.

Photograph 3.

Group 3. Photograph 1. Primary condition of saddle-nose of moderate degree. Operation, January 9, 1914; section of distal phalanx and rib anchorage. German Hospital, Kansas City, Missouri.

Group 3. Photograph 2. Exhibits again growing of a rib to a finger, this time without skin of chest-wall covering. Cartilage covered with prolific granulations, February 21, 1914, when implantation into nose was made as described.

Group 3. Photograph 3. Shows result fourteen days after section of rib-cartilage from the finger.

under surface was brought into contact. Anchoring facial suturing and maintenance was the same as before. On the tenth day the finger tourniquet indicated the feasibility of sectioning the finger from the graft, which was done, leaving a vital rib implanted with chest-wall skin, growing, a fixed part of the nose. The small fragment of cartilage left in the finger was removed and the finger restored.

When, in the case of a collapsed nose, a finger is used, as was done by Finney,[1] a primary plastic sectioning is done for the construction of the septum. Starting well over to the left side of the nasal covering a flap is dissected off on the inside of mucous membrane, with some effort to include portions of cartilage, and the dissection is carried well over to a point opposite and left attached to hang down. A similar flap is turned up from the nasal floor to join this. When the dorsum of the finger is denuded, it is done by making a flap of those tissues, starting well over on the left margin of the dorsum and carrying the dissection to the middle of the anterior surface of the finger, where it is left to hang with its raw surface to be apposed to the raw surfaces of the two nasal flaps already made; making a completely lined septum, and with the surface created above by the dissection from the nasal integument coming into contact with the denuded finger, no raw surface whatever is left. The assemblage of these tissues in section is illustrated in Fig. 3. The phalanx remaining for projection is freshened only at the point where it joins the septum, and its shrinkage is left to tube pressure in the nostrils, which is kept up until it is accomplished, most of the time being inserted only at night. By the sacrifice of a finger in this way a perfect

[1] Surg., Gynec. & Obst., 1907, v, 23.

result can be obtained; but with the success of chest-wall transplantation, it is obvious that with the application of a Thiersch graft to its under raw surface it could as well be used in much the same manner and the finger saved.

In the correction of the "saddle nose," the method of transplantation of a chest-wall flap was put to a second test. In a moderately depressed nose the rib was attached to the finger as before, but after sectioning from the chest wall its dorsal skin was lost by sloughing, probably from insecure suturing to the finger or undue mobility subsequently. The integrity of the other tissues, however, was preserved, and in two weeks the rib-cartilage was completely enveloped in a most prolific covering of healthy granulations. To apply this to the nose the columna was divided at its junction with its dorsal cartilages and the section carried through the septum to the margins of the nasal bones; the depressed soft tissues were then freely elevated on both sides and above. The granulations on the graft were shaved well down to the cartilage until it was fashioned exactly to correct the deformity; then it was passed into the nasal pocket created for it, anchored, sutured, an kept in a cast much as before. This was maintained for only one week, when it was separated from the finger and has remained perfecty without shrinkage. The columna later was restored.

In five cases of deformity treated by these methods, one complete nose was successfully constructed (Case 1); three elevations of collapsed nose with loss of septum were made by use of the finger (as represented in Case 2); twice the rib was carried by the finger, once for the improvement of the finger-nose and once for the correction of a saddle-nose deformity (Case 3).

THE DUODENUM: A RÖNTGEN STUDY[1]

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UP to the present we have known but little of the physiology or pathology of the duodenum in the röntgen picture. In most cases shortly after the ingestion of a bismuth meal a shadow appears in the duodenum—the bulbus. This is of great importance in determining the position of the pylorus, which is easily recognized as a linear cleft between the pyloric portion of the stomach and the duodenum. What little could be seen in the normal duodenum was described by Holzknecht[2] in the following words: "The fluid content of the stomach passes into the duodenum in two ways: First, without help of the ventricular peristalsis; for example, when a bismuth water suspension which does not require stomach digestion is taken on an empty stomach with open pylorus. Second, by means of antrum peristalsis the stomach rhythmically empties its fluid contents into the duodenum. The jets of gastric contents collect in the first half of the pars superior duodeni. Its breadth and easy dilatability break the force of the stream which is propelled through the pylorus. The chyme halts here for a short time before it proceeds upon its relatively rapid course through the rest of the duodenum and small intestine. Small amounts may remain here for a long time, perhaps undergoing a secondary digestive process similar to that in the stomach. When the contents exceed the capacity of this segment the excess is seized and carried away by the peristalsis and the freshly arrived bismuth lies in its place. The exceptional function of this part of the duodenum made it desirable to give it a special name (bulbus duodeni). This includes the widened first half of the pars superior. The bulbus takes very little part in

[2] Das normale röntgenologische Verhalten des Duodenums. Zentralbl. f. d. ges. Physiol., 1910, xxxiii, 26.

[1] Report during the *Studienreise* of the German Röntgenological Society in Vienna, September, 1913. From the Radiological Institute of Dr. Guido Holzknecht.

peristalsis, perhaps only by means of general tonic contractions. Thus it appears that the bulbus duodeni has a special duty to perform: it acts as a buffer against the spurting of the antrum as well as a kind of secondary stomach. On the other segments of the duodenum the contents progress as coin-sized bits with unclear margins, which do not unfold or completely fill the duodenum in any part. This progression occurs in periods lasting several seconds and alternating with periods of rest which may last for minutes. The first station is, as a rule, between the pars media and the pars inferior, the next in the jejunum."

Of pathological conditions in the duodenum we have known, up to the present, (1) the ptoses (Chilaiditi), and (2) the stenoses (Holzknecht), with the following radiological syndrome:

1. Filling of the duodenum above the seat of the stenosis so that the wall of the duodenum is sharply outlined. 2. Ineffectual or partly effectual peristalsis of the filled duodenum causing a change in the form of the organ but no change in position of contents. 3. Retention above the stenosis. 4. Occurrence of paralytic dilatation above the stenosis.

Both retention and dilatation can involve the stomach as well as the duodenum. The stomach almost always is involved in stenoses of the upper part of the duodenum, more rarely in stenoses in the neighborhood of the duodenojejunal flexure. The differentiation of spasmodic and organic stenoses was rarely possible. The diagnosis of adhesions which had not produced stenoses was thought possible. The condition of chief importance — duodenal ulcer — could not, however, be directly diagnosed from the röntgen picture. It was possible only to make a probable diagnosis from the clinical history of an undoubted ulcer and in connection with this history a röntgenologically normal stomach. In typical cases hypermotility is present, perhaps symptoms of stenosis changing from day to day, and often a tender point corresponding to the course of the duodenum. A duodenal niche is very rare. Cole [1] and George and Gerber [2] claimed that they could

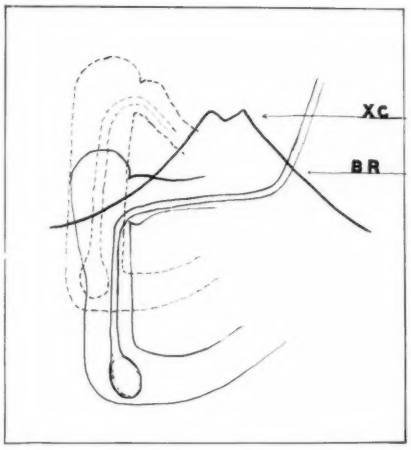

Fig. 1. XC, Xiphoid cartilage. BR, Border of ribs. Duodenum (solid line) in inspiration, duodenum (dotted line) in expiration.

directly diagnose duodenal ulcer by means of serial radiography. Our limited experience at that time did not permit us to realize the real value of their work.

Within the last two years eight or nine men, independently of each other, came upon the idea of filling the duodenum with bismuth through the duodenal tube. Skinner,[3] in Kansas City, was the first, so far as I know, to carry it beyond the experimental stage. I did this for about six months, but was unable to get uniformly good results because the bismuth flowed away through the duodenojejunal flexure, or, if it halted in the passage, rarely remained in sufficient quantity for any length of time, as the peristalsis soon carried it farther. Finally, with Holzknecht I modified the conditions of work by the very simple expedient of putting his distinctor (or compressor) at some point along the duodenum, usually at the duodenojejunal flexure, which is located through its bismuth shadow, and not by following any preconceived anatomical idea. Moderate pressure with the "distinctor" is sufficient. Thus we dammed back the bismuth and secured a complete filling of the lower part of the duodenum and a lesser filling of the rest of the organ.

[1] Cole, Arch. Röntg. Ray, 1912, Apr.

[2] George and Gerber, Arch. Internal Med., 1911, Dec.

[3] Skinner, Arch. Internal Med., 1911, Dec.

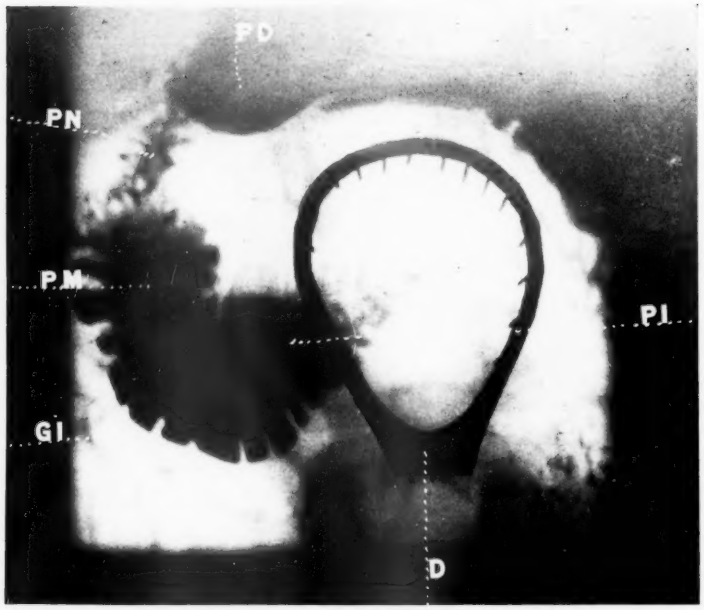

Fig. 2. PD, par superior duodeni; P, pylorus; S, stomach; PI, pars inferior, duodeni compressed at duodenojejunal flexure; D, distinctor; GI, genu inferius; PM, pars media; PN, physiological narrowing at genu superior.

At our leisure we can study this picture, measure the time of individual peristaltic waves, look for defects in the duodenum, and watch the excursions of the "fixed" organ with respiration and with retraction and relaxation of the belly-wall. In the normal case the duodenum is freely movable in all its parts. In the supine position with forced expiration, or with retraction of the belly-wall, only the lower pole of the duodenum is visible under the border of the ribs. This fact is difficult to bring into consonance with our present conception of the anatomy of the duodenum. Despite this, I wish to emphasize the fact that the duodenum as a whole — not the pars superior nor the pars inferior alone, but the whole organ — moves up and down with respiration, and even more so with tensing of the abdominal muscles (see Fig. 1).

My idea of the cause of this movability may be expressed in the following crude comparison. The peritoneum is applied to the internal body-wall like the fabric of a man's vest to the external body-wall. A watch-chain might represent the stomach fixed to the wall in two places, movable either with the fabric when the vest as a whole moves, or independent of the fabric by pushing up the center of the chain. The duodenum might be considered as a braid sewed upon the fabric and moving only with movements of the vest itself. The diaphragm and the liver together probably serve to tense the peritoneum and thus pull up all the abdominal organs, especially with forced expiration and concomitant retraction of the belly-wall.

In order to facilitate our work and save time we (Holzknecht and the author) have adopted the following nomenclature (see Fig. 2): bulbus, pars superior, genu superius, pars media, genu inferius, pars inferior, concavity and convexity.

Figure 2 shows the duodenum taken with the patient in the erect posture during peristaltic rest; notice the physiological defect at the genu superius, due, first, to the bend in the duodenum at this point, and second, to the sedimentation of the bismuth suspension

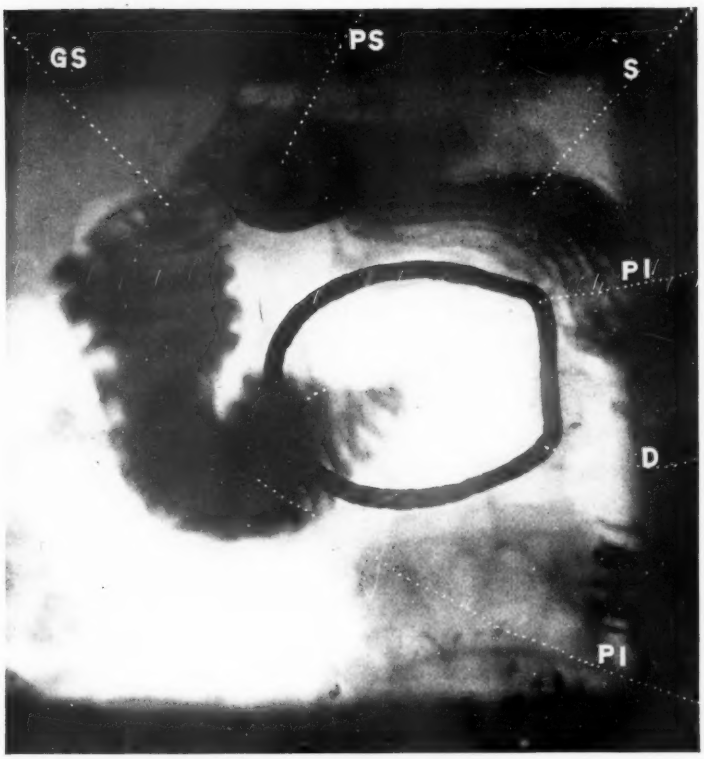

Fig. 3. S, stomach; PI, pars inferior; D, distinctor; GI, genu inferius; PM, pars media; GS, genu superius; PS, pars superior.

(gravity effect). Figure 3 shows the duodenum in active peristalsis with partial obliteration of the apparent defect. In the supine position this apparent defect is also less marked.

I will not trouble you with the technique of the examination which Holzknecht and the author demonstrated before the *Naturforscherversammlung*. Suffice to say that the Gross tube is introduced into the duodenum and bismuth water suspension injected.[1] The duodenum is first observed without compression and then with compression in the neighborhood of the flexure duodenojejunalis. We see ordinarily a C-shaped sausage-like tube with a smooth-walled pars superior and a pars media and pars inferior marked by their Kerkringian folds. The latter give these parts their characteristic feathery appearance when the filling is partial. On more complete filling the lower part of the duodenum appears as a cogged or toothed tube merging into the less completely filled jejunum (Fig. 2). The starting point of the large waved peristalsis of the duodenum is apparently just after the bulbus; the wave runs down the pars superior and pars media till it reaches the obstructing distinctor. At the same time the bismuth is forced up against the genu superius, but very little flows back into the pars superior. The peristalsis in the normal duodenum usually proceeds in regular waves, the time of a complete peristole varying in duration in the individual case from five and one-half to seven and one-half seconds. There is no apparent difference in the peristaltic period whether the olive is in

[1] Technique of Lippman, J. Am. M. Ass., 1914, Mar. 21.

Fig. 4. Variant.

the duodenum or not. The exact time of individual waves is difficult to determine, as the beginning and end of the peristaltic movement are not very well defined. Of course, we realize that we are not working under nor observing physiological conditions, but then again none of the radiology of the gastro-intestinal tract is done under strictly normal conditions. We merely need normal standards of comparison in our diagnostic work.

In our pathological cases the peristalsis is much more irregular, the duodenum contracting rhythmically for a few wave periods, then frequently resting for minutes at a time, then perhaps showing a single wave of peristalsis, to relapse again into a period of quiescence. We were unable to offer an explanation for this irregular peristalsis, although we knew from unpublished experiments of Dr. Hruby of Budapest that after artificial excitement of peristalsis in the exposed duodenum the organ soon enters upon a period of rest. We observed later when injecting barium in a solution of 0.5 per cent HCl that peristalsis, contrary to our expectations, was never excited and if peristalsis were present it often stopped. We thought, therefore, that the excess of acid in our pathological cases might be one of the factors in the causation of this irregular peristalsis. We made further experiments on the exciting factors of duodenal peristalsis which I hope to publish in a later communication. We often take advantage of these facts by withdrawing the tube after a short period of compression, combined with the injection of 0.5 per cent HCl, and observing the bulbus.[1]

In our work we can see the filled duodenum, observe it in action, and gain the advantages which are obtained in gastric radiology by observing the motions of the bismuth in the stomach. For example, by pressing out a coil with our distinctor, or by having the patient contract his belly-muscles, thus moving the duodenum upward and very often dissolving a supposedly adherent coil, we see whether a coiled duodenum is merely a variant or is due to adhesions. Then, again, we may turn and twist the patient, examining the duodenum in all positions. This is important, as, for example, when a bismuth blotch in the sagittal projection is easily resolved into a coil of duodenum when the patient is turned into a diagonal position. Figure 4 shows a variant, the duodenum being shaped as is shown in the illustration, but every part was freely movable so that we could straighten the duodenum out into a simple curved tube. In this picture we see a filling of the duodenum without the tube but with compression of the duodenum. By this method very good filling may be obtained in many cases, in others none at all. This is very prettily illustrated in a case with marked hyperacidity, retention of one-quarter of the bismuth meal after six hours and of approximately one-sixth after papaverin (gr. 1) had been given (pylorostenosis ?). We were unable to fill the duodenum by means of effleurage, but obtained a very pretty filling through the duodenal tube.

[1] Holzknecht and Lippman. Fortschr. d. Röntgenheilk., 1914, Feb.

The advantages claimed for these methods of filling the duodenum, with compression at the *duodenojejunal flexure*, are: (1) More complete filling of the duodenum with the exception of the bulbus; (2) observation of the peristalsis and the mobility of the duodenum fluoroscopically; (3) more exact determination of the location of the tender points; (4) observation of niches and defects in the duodenal picture; (5) diagnosis and differentiation of duodenal adhesions or variants; (6) dislocation due to extraneous causes; e. g., pancreatic tumor.

As yet the most important part of the duodenum is not attacked by the tube method. In the course of the ordinary examination of the stomach we almost always see a more or less complete cast of the bulbus according to the amount of bismuth which succeeds in passing the pylorus during the examination. In the tube filling, on the contrary, the bulbus duodeni is usually very little if at all filled. In our latest attempts we have succeeded in filling the bulbus more completely by withdrawing the tube into the stomach after the filling has been accomplished.

However, the filling of the bulbus with any approach to completeness is technically the most difficult part of the duodenal examination. It seems to me that a combination of the various methods (the ordinary examination in different positions of the body; the observation of Cole's duodenal defects either by serial radiography or more easily by fluoroscopy [1] with the aid of the Bucky [2] effect; effleurage with or without compression at the duodenojejunal flexure and the tube method) will best lead us to our diagnostic goal.

[1] Holzknecht and Lippman (in press).
[2] Holzknecht, München. med. Wchnschr., 1914, No. 49, Dec.

SYNDESMORRHAPHY AND SYNDESMOPLASTY*

The Operative Treatment of Ruptured Ligaments

By CHARLES E. PHILLIPS, M. D., Los Angeles, California
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I APPROACH this subject with a certain hesitancy because I realize that the procedures I am about to describe have probably been practised many times in the past. However that may be, it has not been my good fortune to see them described, and I must confess that for lack of specific knowledge I have let slip many opportunities to benefit patients. Furthermore, I have seen many cases in which the same might be said of other surgeons. These are the reasons for my remarks.

The word syndesmology (from Gr. *syndesmos*), signifying the science of ligaments, has been used. Now from the same source I desire to suggest the coining of two new words: (1) *Syndesmorrhaphy*, by which, as the word indicates, is meant the suture of ligaments as in the simple repair of a cut or torn ligament. (2) *Syndesmoplasty*, by which is meant a plastic operation on a ligament whereby the ligament may be shortened, lengthened, imbricated, or strengthened by folding, grafting, or transplantation of other ligamentous structures to take the place of, or reinforce, a weakened or lacerated ligament.

Syndesmology, the science of the ligaments, has not received the attention from the surgeon that its importance warrants; in fact, it has received hardly any attention at all from the great majority. The lack of knowledge regarding the ligaments has resulted in so many cripples that the belief among the laity has crystallized into the maxim, "A sprain is worse than a break." This probably has a substantial element of truth in it.

In treating a fracture every endeavor is made to approximate accurately the fractured ends of the bone, or to reduce them as nearly as possible to their normal position

* Read before the Los Angeles County Medical Society, May 21, 1914.

Fig. 1. Dissection of internal aspect of knee. Sartorius muscle lifted up. Forceps passed under internal lateral ligament. Tip of forceps resting upon the gracilis tendon, showing insertion of gracilis tendon at base of internal lateral ligament.

Fig. 2. Skiagraph, Case 3. Lateral view showing patellar tendon fixed by means of nails.

and retain them in such position until healing has taken place. In treating a ruptured ligament, however, there is usually no endeavor at all made to approximate the torn ends of the ligament. It is not taken into consideration that accurate approximation is more necessary in the case of torn ligaments than in fractured bone. The bone will bridge over a moderate space and regenerate as strong, if not stronger, than before, while the ruptured ligament makes but feeble effort to bridge over a space and practically never becomes as strong as before. Possibly our carelessness in the matter is due to the fact that we have nothing to show us the relative position of the torn fragments. We satisfy ourselves that no fracture exists and then neglect to find out the amount of injury that has taken place in the ligaments.

In a certain percentage of cases the rupture is only partial, and the ends remain in fair apposition. In other cases the rupture may be complete and the ends retracted on themselves, leaving a space impossible to bridge. We find the conditions exactly reversed from those found in fractures. In the latter the bone acted on by the muscular pull tends to overlap the broken ends and an opportunity is given for a strong repair, while in rupture of the ligaments the bones lose their support and the ends of the torn ligament are drawn farther apart. Consequently, it behooves us to make every endeavor in cases of sprains to determine the character and extent of the injury.

The reparative powers of the various portions of the body vary greatly, but one of the slowest structures to regenerate and become strong after separation is the white fibrous tissue of the ligaments. The healing powers of an organism can do a great deal to repair the damage done in most cases when given an opportunity by rest of the affected part, but there still remains a considerable number of cases of complete rupture of ligaments with more or less retraction of the ends where the reparative powers are insufficient and we have remaining a permanently impaired joint. In injuries of the ankle-joint, where the ligaments are comparatively short, retraction to any great degree is impossible; hence, the worst we can have is simply a weak ankle suffering from recurring sprains as the torn structures are united by scar-tissue and broken again when subjected to strain.

If the shoulder-joint happens to be the one affected we will probably have a series of recurring dislocations which will go on in-

definitely until cured by operative interference, or until the patient learns, to a greater or less degree, to prevent recurrences by unconsciously refraining from assuming a position of the arm that leads to dislocation. Long-continued irritation by the movements of the arm may give rise to a chronic synovitis, eventually limiting the motion to such a degree as to prevent a recurrence of the trouble.

The acromioclavicular articulation is frequently the site of severe injuries. Falls on the shoulder, heavy weights striking the shoulder, or sudden violent forces throwing the shoulder backward, frequently cause a rupture of the trapezoid, conoid, acromioclavicular, and capsular ligaments, allowing the shoulder to sag down or the outer end of the clavicle to project upward. An abnormal projection appears on the outer portion of the shoulder corresponding to the outer end of the clavicle. If the case is not seen until swelling and ecchymosis have appeared the diagnosis may not be possible until the swelling subsides. If allowed to go untreated, the shoulder becomes weak and painful, and the patient is incapacitated for heavy labor.

The joint that above all others, when affected, leads to disability is the knee-joint. It is not so frequently affected as the others, but the disability arising from a rupture of the ligaments of the knee is very serious and lasting. This is apparent on anatomical grounds. The ligamentous structures about the knee are so strong that when they are caught at a disadvantage so that the knee cannot bend with the force, the bone frequently breaks before the ligaments give way. When the ligaments do give way, however, as in rupture or sprain fracture, the length of the ligaments predispose to a wide separation of the broken ends (hence, to a slow and insecure repair), while the length of the leverage and weight to be borne necessitate great strength to withstand the strain. Taking these facts into consideration, is it small wonder we find so many braces worn to assist an injured knee in performing its functions?

DIAGNOSIS AND TREATMENT

In the treatment of ruptured ligaments, as in the treatment of any other condition, the prime factor is the diagnosis. This is not always easy. In cases of joint injury we should try always to detect abnormal mobility. If the examination is made soon after the injury the findings are important, while if the time for swelling and ecchymosis has elapsed it will not give a true index to the severity of the lesion. Motion that otherwise might be very abnormal is so limited by swelling, extravasation, etc., as to render it normal. A careful skiagraph should be taken of the affected part to rule out fractures or sprain fractures. Then, unless a rupture is demonstrated, the affected part should be placed at rest and, in due time, treated by massage, hydrotherapy, etc. When the swelling and tenderness have subsided, the joint should again be examined for abnormality. This is where the slow-growing ligamentous structures stand us in good stead. An overlooked fracture unites in malposition and much callus is produced, rendering a late repair very difficult. A ruptured ligament, on the other hand, makes little effort at uniting, and months after an injury it may be found practically unchanged and may be united and result in great improvement or permanent cure of the condition.

In the cases of injuries to the acromioclavicular articulation, the diagnosis can best be made, when the swelling has subsided, by grasping the shoulder with one hand and the clavicle with the other, whereby any abnormal mobility may be detected easily by comparing the sides.

The treatment is simple and efficient: An incision is made over the outer third of the clavicle, extending over the acromion process just beyond its outer edge. The skin, fascia, and a few fibers of the deltoid muscle are retracted, exposing the outer end of the clavicle, the acromioclavicular joint, and the acromion process. Two holes are then drilled through the acromion process, beginning at its outer edge and drilling inward and slightly downward so as to come out on the under side of the acromion just below the acromioclavicular articulation and about one-half to three-quarters of an inch apart.

The outer end of the clavicle is now forced

down into place. If the condition is of long standing it may be necessary to remove a little of the bone to allow it to be replaced. Two holes are drilled through the outer end of the clavicle, coming out on the under side as near as possible to the holes through the acromion. Each end of a medium heavy silver wire is passed inward through the holes in the acromion and then upward through the holes in the clavicle. The clavicle is pushed down into place, the wire drawn tight and twisted to hold. This virtually forms a mattress suture of silver wire to hold down the end of the clavicle and brings the torn ends of the conoid and trapezoid ligaments into direct apposition. The acromioclavicular ligament is sutured with chromic catgut and the skin is closed. The dressing is applied and the arm allowed to rest in a sling.

This operation I have performed a number of times, and the results have been very satisfactory.

The diagnosis may be made with more ease and certainty in injuries to the knee than in any others, as the ginglymus joint with its superficial position and long leverages lends itself to an easy diagnosis and adapts itself to a ready repair. The X-ray helps only in a negative way, but its use is absolutely essential, as it may reveal some unsuspected conditions.

The repair is accomplished by simple suture or by a syndesmoplastic operation. When the internal lateral ligament is ruptured it may be reinforced by superimposing the tendon of the gracilis muscle upon it. See Fig. 1.

We may state that we have an operative condition of the ligaments—

1. In frank injuries where there is reasonable grounds for suspecting a completely ruptured ligament.

2. In old sprains where after the lapse of one or two months there is still distinct abnormal mobility.

3. In cases of recurring sprains leading to frequent disabilities we should endeavor to relieve the condition by repair of torn ligaments or by transplantation of strong fascial structures from other portions of the body.

4. In compound sprains or in compound dislocations. In these cases we should not consider our duty fulfilled to the patient until we have repaired the main ligamentous structures by either an immediate or late repair, whichever we consider most appropriate in the individual case.

In the following case reports (one selected from each division) the first one naturally falls into the first division, the second is that of a late repair, and the third is a compound rupture of the patella tendon and accessory ligaments.

CASE 1. J. G. G. fell down an embankment May 3, 1912, and in falling twisted his right knee under him. He does not know exactly how it happened. On attempting to rise he found that the right knee was useless. He was sent to Ancon Hospital the same day. The leg was treated with elevation, immobilization, and ice. At the end of six days the swelling had subsided to a considerable degree, and on examination it was found that the knee possessed an abnormal lateral motion. The extended leg could be abducted to nearly a right angle with the thigh, showing conclusively the complete rupture of the internal lateral ligament. The extended leg could not be abducted beyond the straight line, showing the presence of uninjured external lateral ligaments.

On May 10, 1912, seven days after the injury, under ether anæsthesia I laid bare the internal lateral ligament by a longitudinal incision about six inches long over the course of the ligament, exposing a field well beyond its upper and lower limits. The ligament with rupture in lower third was easily demonstrated. The torn ends of the ligament had retracted and curled up on themselves, causing a separation of at least one and one-half inches between the ends. The expansion from the quadriceps tendon on the inner side of the patella and the joint capsule were both ruptured.

The joint capsule was sutured with catgut, while the torn internal lateral ligament and expansion of the quadriceps tendon were sutured with a heavy thirty-day chromic gut. The whole ligament was reinforced by transplanting the tendon of the gracilis muscle. The periosteum over the adductor tubercle was incised and the tendon sutured to the periosteum and to the origin of the lateral ligament just below the adductor tubercle. It was not necessary to transplant the lower end of the gracilis tendon, as its insertion is just below the attachment of the lower end of the internal lateral ligament. It was superimposed on the lower end of the internal lateral ligament by a chromic stitch, thereby reinforcing the ligament with the tendon. In doing this the tendon was not severed at all, but simply displaced forward and fastened in two places — once at the lower end of the lateral ligament and once at the upper end. The ease with which this was accomplished may be appreciated by a glance

at Fig. 1, a hasty dissection of the internal aspect of the knee. The skin was closed and a dressing applied with a long external splint well padded at each end to overcome the tendency toward genu valgum.

At the end of ten days the dressing was removed, the stitches were taken out, passive motion was given the knee, and splint was reapplied. For fear the patient might inadvertently injure the repaired ligament in his sleep, passive motion was given every few days for about one month, at which time the splint was removed entirely and the patient encouraged to move the knee.

The range of normal motion rapidly increased, while the lateral motion was hardly perceptible. He was discharged from the hospital July 10, 1912, two months to a day from operation, able to walk with only a slight limp on level ground. He had considerable difficulty in going up an incline or up and down stairs. I did not see the patient again until October 1, 1913, when he was admitted to Colon Hospital. He reported that steady improvement had taken place since operation nearly seventeen months ago, and that the knee was to all appearances normal in motion and function.

Case 2. H. R., Jamaican, Colon Hospital, No. 42305, fell in front of a moving handcar in Colon, September 30, 1912, sustaining a compound comminuted fracture of the left leg in the middle third and rupture of the internal lateral ligaments of the left knee-joint. Wound was cleansed and dressed. As the position was good, no retentive apparatus was necessary, and none was applied other than an internal and external splint. At the end of two months the fracture was well, union strong, and position good, but the patient was unable to walk on account of lateral motion of knee-joint. The knee would buckle inward when walking was attempted.

He was treated with splints and immobilization until February 28, 1913, a period of five months from the time of injury, without improvement in his condition. On February 28, 1913, patient was etherized and I exposed the internal lateral ligament by means of a longitudinal incision over the entire length of the ligament.

In this case I found the rupture had taken place in the upper third of the ligament. Part of the fibers had broken off just below its origin under the adductor tubercle, and part of them had broken lower down, causing an irregular rupture with a moderate degree of separation but no effort to repair. A simple syndesmorrhaphy was performed; the lower end was freed and brought up and sutured to the upper end and to the fascia and periosteum over the internal condyle by means of chromic catgut, while the leg was held in a straight position. The wound was closed and dressing applied with a long external lateral splint to prevent genu valgum and tension on the ligament until healing occurred.

Passive motion given as in Case 1. Lateral, motion was reduced to almost normal limits by the operation. Improvement was fairly rapid. In two and one-half months patient was able to walk with a stick. Improvement continued until June 1, 1913, when he went back to Jamaica. The following note was made on his discharge from hospital: "Knee much improved; almost no lateral motion; flexion and extension normal. Walks well on level ground. Has trouble only on going up stairs or up an incline."

While the operation improved this patient immensely, I believe that a transplantation and utilization of his gracilis tendon to reinforce the ligament would have given him a stronger knee.

Case 3. H. S., Colon Hospital, No. 46504, American, white, age 23, was knocked off lock wall at Gatun, April 23, 1913, by a broken chain, and fell into a valve pit, a distance of nearly fifty feet.

Among other injuries was one to his right knee, which struck on the sharp edge of the concrete pit, widely opening the knee-joint and knocking off the inner portion of the tuberosity of the tibia with its attached portion of the patella tendon; then, ranging upward and outward, the patella tendon was severed the remainder of its width in an oblique direction, together with the accessory portion of the quadriceps tendon. Everything was carried away as far back as the lateral ligaments.

Under ether anæsthesia the wound was cleansed, the edges were trimmed, the patellar tendon was sutured with chronic catgut, and that portion of the tuberosity of the tibia which had been pulled loose was pulled down and fixed in its original position by means of nails (see skiagraph). The skin was closed with a small cigarette drain and dressed with a 3 per cent carbolic dressing.

After thirty-six hours the wound was redressed with the same strength carbolic dressing after the drain had been removed. The patient ran a slight febrile reaction for six days. Stitches were removed at the end of two weeks, when wound was healed. Slight passive motion was started. Improvement was gradual.

On July 10, 1913, the patient was walking with the aid of a stick and went to the States on leave. He returned October 11, 1913, when I found the following condition: Movements of the knee were normal in flexion and extension. Patient can walk on a level, up stairs or up incline, but experiences some difficulty in going down stairs. The only abnormality that can be found is a slight weakness in the anterolateral movements of the knee, probably occasioned by the destruction of the accessory position of the quadriceps expansion. Otherwise the joint apparently is normal. He states that there has been a steady improvement.

In conclusion I wish to state that I believe we have been entirely too conservative in our treatment of severe sprains. I believe we should be as ready to repair a ruptured ligament as to mend a broken bone.

THE PHENOLSULPHONEPHTHALEIN TEST FROM THE VIEWPOINT OF THE ABDOMINAL SURGEON

By STEPHEN E. TRACY, M. D., Philadelphia

PHYSICIANS long have realized what a great aid in diagnosis, in prognosis, and in the selection of operative cases would be a simple and accurate method of determining the functional activity of the kidneys. During recent years many methods have been advocated, most of which have fallen into disuse, some because the technique was complicated, others because the results were not accurate, and yet others for both these reasons.

The most popular method has been the hypodermic administration of substances giving a color to the urine. Many dyes have been used for this purpose. The advocate of each dye has claimed for it virtues not possessed by its predecessors. The latest substance to receive wide attention is phenolsulphonephthalein. When the results obtained from the use of this drug were reported, it seemed that at last we had a functional test simple and easy of application and accurate in its results.

It was hoped that some article on the subject would state the minimum percentage output which would be safe for surgical operations. Such information, to the best of my knowledge, has not appeared, nor have I been able to obtain definite data on this point from one who had experience with the test.

Charles Goodman[1] has reported a death from uræmia following a suprapubic cystostomy under local anæsthesia for complete retention of urine due to an enlarged prostate. The phthalein output was 27 per cent. Wm. F. Braash[2] has mentioned cases subjected to operation in which the phthalein output was below 15 per cent and the patients made good recoveries. Rowntree, Geraghty, and Marshall[3] have reported a case of prostatectomy in which the phthalein output was 8 per cent; the patient recovered.

[1] J. Am. M. Ass., 1913, lxi, 184.
[2] J. Am. M. Ass., 1913, lxi, 942.
[3] Surg., Gynec. & Obst., 1914, xviii, 196.

One evening, after listening to a very interesting and impressive discussion on this test by Doctor Rowntree, I inquired what he considered the minimum percentage output which would be safe to undertake operations. His reply was, "The greater the output the less the risk"; nor could I obtain from him definite information on this point. I then decided to use the test as a routine procedure, to ascertain, if possible, what would be the minimum percentage output to safely undertake surgical operations, and to determine if the test would be of value to the surgeon in his routine work.

I have employed the test in about three hundred cases — not consecutive cases, as that was not possible; I took them as they came with absolutely no selection. While employing the test in the routine work, I paid absolutely no attention to the reports in the selection of cases for operation, but decided on other data previously used. The material for this paper is based on the observations of the first one hundred cases, on which one hundred twenty tests were made, and the total output represents the percentage excreted in two hours.

When injected deep in the lumbar region, the time in which the phenolsulphonephthalein appeared in the urine varied from five minutes to forty-two minutes, the average being ten minutes and eighteen seconds, or approximately ten minutes.

The output in the case in which the dye appeared in forty-two minutes was approximately only 2 per cent less than the average output for the series. Three tests were made on this patient. In the first test the dye appeared in twenty-five minutes and the output was 37 per cent. The next day the test was repeated; the dye appeared in forty-two minutes and the output was 53 per cent. Twenty-four days later the test was again applied and the dye appeared in eleven minutes, the output being 55 per cent. The

last test was made after the patient had recovered from an acute pelvic peritonitis.

The output varied from 21 per cent to 96.5 per cent. The average output in the series for the first hour was 34.27 per cent, for the second hour 20.83 per cent, and for the two hours 55.1 per cent.

In ten, or 8.3 per cent of the tests, the percentage output was greater in the second hour. In 20 per cent of the total tests made in this series, 4 per cent or less than 4 per cent was the difference between the output for the first and second hour.

In this series five cases with approximately 25 per cent output were subjected to major operations.

CASE 1. The patient, age 36, was suffering with a right pyonephrosis. When admitted to the hospital the phthalein output was 21 per cent. Four days later the output was 27.5 per cent. The following day the right kidney, which was a pus sac, and the upper ten centimeters of the ureter were removed. The patient had an uneventful recovery. Ten days after the operation the phthalein output was 32.5 per cent. Eighteen days after the operation the phthalein output was 37 per cent. Five months before this admission, renal calculi had been removed from the left kidney and ureter. Had the phthalein test been applied at that time the output would have been *nil*, as there was anuria, yet the patient made a good recovery.

CASE 26. Mrs. P., age 48, had acute appendicitis. When admitted to the hospital the phthalein output was 23 per cent. The appendix was removed the following morning and the patient made a rapid recovery.

CASE 39. Mrs. G., age 37, was admitted to the hospital with a diagnosis of a laceration of the cervix uteri and of the perineum, cystocele, and bilateral suppurative salpingitis. The phthalein output was 25 per cent. A dilatation and curettement, a trachelorrhaphy, an anterior colporrhaphy, a perineorrhaphy, and a bilateral salpingectomy were performed. The patient had a normal convalescence.

CASE 42. Mrs. B., age 42, was admitted to the hospital with a diagnosis of laceration of the cervix uteri and the perineum, and hydrosalpinx. The phthalein output was 24 per cent. The patient was subjected to operation for repair of the laceration and a removal of the hydrosalpinx. She had a normal convalescence.

CASE 75. Mrs. S., age 61, complained of discomfort in the pelvis and of some irritation of the bladder. She had had two operations on the anterior and posterior vaginal walls with little relief from the discomfort. Cystoscopic examination revealed a large vesical calculus. When admitted to the hospital the phthalein output was 27.5 per cent. The stone was removed by a suprapubic cystotomy. The patient had an unusually easy convalescence.

These five cases had the smallest percentage of phthalein output in the series. All were considered good surgical risks; all had an easy convalescence with no evidence of renal disturbance. In this connection, it is interesting to compare the results in a series of a low percentage output with a series of a higher percentage output.

CASE 54. Mrs. H., age 52, was subjected to operation for a malignant ovarian cyst. When admitted to the hospital the phthalein output was 66 per cent. The patient had a stormy convalescence. The quantity of urine excreted was small and contained albumin and many casts.

CASE 56. Mrs. L., age 46, was sent to the hospital for a radical operation for carcinoma of the cervix uteri. The phthalein output was 53 per cent. She was considered a bad surgical risk, and curettage and cauterization only were done. She died of uræmia in less than two months.

CASE 59. Mrs. B., age 40, was sent to the hospital for operation for carcinoma of the cervix uteri. The phthalein output was 72 per cent. She was considered a bad surgical risk, and an application of the cautery only was made. She died of uræmia in less than one month.

CASE 69. Mrs. B., age 49, was admitted to the hospital for a curettement for metrorrhagia. Microscopical examination of the tissue removed by the curette showed the lesion to be a carcinoma of the corpus uteri. The phthalein output on admission was 55.5 per cent. Although there was no apparent extension of the malignant process beyond the uterus, this patient was considered a doubtful surgical risk. We decided, however, to give her the benefit of a complete hysterectomy, the patient being on the operating table about forty minutes. The first few days after operation the normal amount of urine was excreted. Then the quantity began to diminish until it reached, on the fifteenth day, 360 ccm. in twenty-four hours and there was well-marked evidence of uræmia. At this time the phthalein output was 58 per cent. The patient remained in a state of mild, and at times, of well-marked coma until the fifty-second day after operation, at which time she passed away.

CASE 79. Mrs. J., age 23, was admitted to the hospital because of a marked toxæmia of pregnancy. The amount of urine passed in twenty-four hours was about 555 ccm. and contained a large quantity of albumin, many granular and hyaline casts. There was marked swelling of the face and limbs, blindness in one eye and marked impairment of vision in the other. The phthalein output at this time was 66 per cent. It was decided to try rest in bed and appropriate treatment before terminating the gestation. Two days later the quantity of urine had increased, containing decidedly less albumin and

Name and Date	Aged	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
1. Mrs. G. 6/12/12 6/14/12 6/16/12 6/27/12 7/ 5/12	36	11 8 9.5 8 8	11.5 12.5 12.5 17.5 21	0.5 11 15 15 16	21 23.5 27.5 32.5 37	Right pyonephrosis	Five months before, calculi which caused anuria were removed from left kidney and ureter.
2. Mrs. S. 6/16/12	24	6	13.5	14	27.5	Left renal colic from hydronephrosis	
3. Mrs M. 6/20/12	54	11	48	31	79	Hæmorrhoids	
4. Mrs. S. 6/26/12	30	8.5	44	27	71	Procidentia uteri	
5. Mrs. D. 8/13/12 8/ 5/12	24	10 9	40 41	25 20	65 61	Acute appendicitis; acute suppurative salpingitis; pregnancy of about eight weeks	Patient miscarried a few days after leaving hospital.
6. Mrs. G. 8/ 6/12	30	10	60	25	85	Laceration of C. and P.; retro. uteri; chronic appendicitis	
7. Mrs. H. 8/ 6/12 8/ 9/12	23	12 10	24 38	20 30	44 68	Six months pregnancy; eclampsia	First test third day after miscarriage.
8. Mrs. B. 8/ 7/12	56	10	35	30	65	Right pyelitis; colon bacillus infection	8/9/12. Test with catheters in ureters. Appearance left side 12 min., right side 18 min. Output for 30 min., left 15 per cent, right 10 per cent.
9. Mrs. W. 8/10/12	44	8	39	17	56	Carcinoma cervix uteri	Wertheim operation.
10. Miss P. 8/25/12	42	10	20	18	38	Chronic tuberculous appendicitis; retro. uteri	
11. Mrs. S. 9/ 2/12	24	8	35	18	53	Bilateral tuberculous salpingitis; chronic appendicitis; tuberculosis of the cæcum	
12. Mrs. T. 9/ 4/12	39	6	40	23	63	Laceration of C. and P.; retro. uteri; chronic appendicitis	
13. Miss C. 9/11/12	25	5	23	15	38	Laceration of C. and P.; prolapsed appendages; chronic appendicitis	
14. Mrs. C. 9/15/12	31	8	26	17	43	Chronic appendicitis; prolapsed appendages	
15. Mrs. B. 9/20/12	35	7	45	15	60	Abscess of the breast	
16. Mrs. P. 9/22/12	49	8	32	23	55	Fibromyomata uteri	
17. Miss M. 9/20/12 9/21/12 10/14/12	20	25 42 11	25 15 32	12 38 23	37 53 55	Acute bilateral pyosalpinx	
18. Miss W. 9/22/12	31	6	55	15	70	Incomplete abortion	
19. Mrs. S. 9/25/12 9/30/12	43	10 10	18 45	55 10	73 55	Left ureteral calculus	
20. Mrs. D. 9/30/12	34	5	39	20	59	Laceration of C. and P.; retro. uteri; chronic appendicitis	
21. Mrs. W. 9/30/12	32	30	20	15	35	Left renal colic; nephritis	
22. Mrs. D. 10/ 8/12	28	6	6.5	25	31.5	Retro. uteri; chronic appendicitis	
23. Mrs. M. 10/14/12	27	27	12	30	42	Pregnancy	
24. Mrs. C. 10/14/12	24	12	30	14	44	Procidentia uteri	

Name and Date	Aged	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
25. Mrs. G. 10/14/12 10/16/12	31	10 20	41 17	15 20	56 37	Laceration of C. and P.; retro. uteri	
26. Mrs. P. 10/15/12	48	12	12	11	23	Acute appendicitis	No renal complications following operation.
27. Mrs. H. 10/15/12	28	7	29	10	39	Laceration of C. and P.; cystocele	
28 Mrs. McE. 10/24/12	49	12	22	20	42	Duodenal ulcer	
29. Mrs. S. 10/26/12	33	8	25	22	47	Cholelithiasis	
30. Mrs. O. 10/29/12	28	10	32	20	52	Retained secundines	
31. Miss T. 10/29/12	17	25	22	20	42	Pregnancy	Sent to hospital with diagnosis of ovarian cyst.
2. Mrs. M. 10/29/12	23	12	26	24	50	Bilateral pyosalpinx; acute appendicitis	
33. Mrs. G. 10/31/12	28	7	25	18	43	Laceration of C. and P.; retro. uteri; movable right kidney	
34. Mrs. A. 10/31/12 11/11/12	64	11 11	22 14	11 12	33 26	Chronic nephritis; cardiovascular renal disease	Much improved by treatment and rest in bed, while percentage output was less. Patient much better when seen eight months later.
35. Mrs. L. 11/11/12	60	10	38	25	63	Laceration of C. and P.; cystocele	
36. Miss H. 11/11/12	24	8	34	18	52	Retroversio uteri; intestinal adhesions	
37. Mrs. D. 11/12/12	30	7	40	30	70	Ectopic gestation with infected hæmatocele	
38. Mrs. G. 11/20/12	30	7	40	30	70	Fibromyomata uteri	
39. Mrs. G. 11/26/12	37	12	15	10	25	Laceration of C. and P.; cystocele; bilateral suppurative salpingitis	Uneventful convalescence.
40. Mrs. E. 10/20/12 11/26/12	30	11 11	20 20	16 14	36 34	Bilateral pyosalpinx; retro. uteri; dense intestinal adhesions; pelvic peritonitis	
41. Mrs. B. 12/15/12	52	8	28	24	52	Cardiovascular renal disease; submucous fibromyoma uteri	Blood pressure, 190 mm. of mercury.
42. Mrs. B. 12/10/12	33	10	14	10	24	Laceration of C. and P.; hydrosalpinx	Normal convalescence.
43. Miss D. 12/10/12	24	5	24	15	39	Intestinal adhesions following appendicectomy	
44. Mrs. D. 12/18/12	30	9	45	33	78	Movable right kidney, down to brim of pelvis	
45. Miss M. 12/18/12	21	8	45	44	89	Retro. uteri	
46. Mrs. B. 1/ 6/13	62	11	25	31	56	Ovarian cyst; procidentia uteri; pulmonary and laryngeal tuberculosis	
47. Miss M. 1/ 7/13	12	8	38	33	71	Chronic appendicitis; gonorrhœal vaginitis	
48. Miss B. 1/ 7/13	19	8	50	24	74	Chronic appendicitis; gonorrhœal salpingitis	
48. Mrs. S. 1/13/12	35	6	50	23	73	Gonorrhœal salpingitis; fibromyoma uteri; chronic appendicitis	
50. Mrs. M.	36	13	20	20	40	Puerperal infection	Recovered.

Name and Date	Aged	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
51. Mrs. G. 1/19/13	22	6	42	23	65	Chronic appendix; adhesions between left ovary and sigmoid	
52. Mrs. K. 1/16/13	35	9	45	23	68	Retained secundines	
53. Mrs. N. 1/14/13	22	11	36	23	59	Abdominal sinus	
54. Mrs. B. 1/18/13	52	12	36	30	66	Malignant ovarian cyst.	Passed small quantity of urine after operation; many casts.
55. Mrs. O. 1/20/13	28	10	50	29	79	Laceration of C. and P.	One month earlier, after an abortion, output was 50 per cent.
56. Mrs. L. 1/20/13	46	13	31	22	53	Carcinoma of cervix uteri	Died of uræmia in less than two months.
57. Mrs. B. 1/24/13	42	9	33	19	52	Laceration of C. and P.; submucous fibromyoma uteri	
58. Mrs. W. 1/28/13	30	9	55	21	76	Laceration of C. and P.; adherent appendages; chronic appendicitis	
59. Mrs. B. 1/28/13	40	9	50	22	72	Carcinoma of cervix uteri	Died of uræmia in less than one month.
60. Mrs. G. 2/ 1/13	29	12	33	18	51	Movable right kidney	
61. Mrs. H. 2/ 7/13 2/ 8/13	43	10 10	23 31	28.5 22	51.5 53	Cystocele and rectocele	
62. Miss B. 2/11/13	21	10	40	11	51	Prolapsed ovary	
63. Mrs. J. 2/17/13	55	7	29	27	56	Laceration of P.; cystocele and rectocele	
64. Mrs. E. 2/11/13	64	6	29	25	54	Gastritis	
65. Mrs. G. 3/19/13	40	10	47	10	57	Fibromyomata uteri	
66. Mrs. J. 2/19/13	35	18	21	8	29	Ovarian cyst	
67. Mrs. C. 3/ 1/13	29	14	25	26	51	Laceration of C. and P.; retro. uteri; chronic appendicitis	
68. Mrs. G. 3/ 7/13	35	5	21	11	32	Laceration of C. and P.; retro. uteri	
69. Mrs. B. 3/ 7/13 3/25/13 3/29/13	49	9 12 12	37 36 34	18.5 23 24	55.5 59 58	Fibromyomata uteri; carcinoma corpus uteri	After operation the patient was extremely low from renal insufficiency. When urine was down to 360 ccm. in 24 hours and there was mild coma, the phthalein output was 58 per cent.
70. Mrs. M. 3/ 7/13	32	16	21.5	12.5	34	Carcinoma of cervix uteri	
71. Mrs. S. 3/ 8/13	26	10	18	16	34	Left salpingitis; chronic appendicitis	
72. Mrs. M. 3/ 8/13	28	9	25.5	17.5	43	Laceration of C. and P.; movable kidneys	
73. Mrs. S. 3/13/13	26	10	32	16	48	Pyosalpinx with acute peritonitis	
74. Miss S. 3/12/13	17	6	42	34	76	Chronic appendicitis	
75. Mrs. S. 3/12/13	61	12	13.5	14	27.5	Vesical calculus	
76. Mrs. C. 3/18/13	28	13	50	30	80	Acute appendicitis ectopic gestation	

Name and Date	Aged	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
77. Mrs. M. 3/22/13	28	11	63	18	81	Laceration of C. and P.; cystic ovary; pelvic adhesions; chronic appendicitis	
78. Mrs. A. 3/21/13	42	9	39	31	70	Laceration of C. and P.; chronic appendicitis	
79. Mrs. J. 4/ 1/13 4/ 3/13 4/ 6/13	23	25 20 12	36 11.5 40.5	30 15 22.5	66 26.5 63	Hydatidiform mole; marked toxæmia	Large quantities of albumin, many casts. Swelling of face and limbs. Loss of vision in one eye and decided impairment in other eye.
80. Mrs. W. 3/31/13	28	7	62	16	78	Retained secundines	
81. Mrs. D. 3/31/13	38	9	38	21	59	Pyosalpinx	
82. Mrs. H. 4/ 2/13	22	13	27	17.5	44.5	Acute appendicitis	
83. Mrs. W. 4/ 2/14	42	14	22	21	43	Purulent appendicitis	
84. Mrs. C. 4/ 2/13	26	9	57	26	83	Laceration of C. and P.	
85. Mrs. Z. 4/ 3/13	42	5	78	18.5	96.5	Laceration of C. and P.; cystocele; chronic appendicitis	
86. Mrs. K. 4/ 5/13	35	9	42	15	57	Dermoid cyst of ovaries; retro. uteri; chronic appendicitis	
87. Mrs. D. 4/25/13	30	9	79	9	88	Chronic arthritis of right ankle	Referred to surgical department.
88. Mrs. B. 4/29/13	49	7	35.5	20.5	56	Irreducible inguinal hernia; laceration of C. and P.	
89. Mrs. K. 4/29/13	38	8	50	22.5	72.5	Complete laceration of perineum	
90. Mrs. W. 5/ 3/13	30	10	42.5	17.5	60	Inguinal hernia	
91. Mrs. E. S. 5/ 1/13 5/ 5/13 5/ 8/13	50	7 5 5	64 60 21.5	29 30 16.5	93 90 38	Renal calculus	Calculus was passed, 5/12/13.
92. Mrs. McK. 5/ 3/13 5/ 5/13	62	5 10	62 43.5	22.5 18	84.5 61.5	Fibromyomata uteri	Urine, specific gravity 1,020. At times a trace of albumin. Glucose 5 per cent to 7 per cent. Blood pressure on admission 220 mm. of mercury. after rest in bed a few days it fell to 180 mm. mercury; Considered a good surgical risk. Hysterectomy, 5/7/13. Convalescence unusually easy
93. Mrs. H. 5/ 5/13	48	5	45.5	20.5	66	Metrorrhagia; laceration of C. and P.	
94. Mrs. M. 5/ 5/13	25	7	40	20	60	Laceration of C. and P.; retro. uteri; subsiding appendicitis	
95. Mrs. F. 5/ 5/13	30	7	43.5	17.5	61	Laceration of C. and P.; retro. uteri; chronic appendicitis	
96. Miss R. 5/10/13	40	14	42.5	20.5	63	Acute appendicitis	
97. Mrs. J. 5/13/13	46	7	23.5	13.5	37	Laceration of C. and P.; retro. uteri; chronic appendicitis	
98. Mr. P. 5/17/13	26	11	55	32.5	87.5	Carcinomatosis abdominalis	Died of renal insufficiency five days after operation.
99. Mrs. McG. 5/ 8/13	25	5	46.5	14.5	61	Fibro-adenoma of breast	
100. Miss S. 5/ 8/13	17	8	46.5	25.5	72	Acute appendicitis	

fewer casts; the œdema was considerably less; there was fair vision in one eye and slight vision in the other. To all appearances the patient was considerably improved and stated she felt decidedly better. The phthalein output at this time was 26.5 per cent. A consultation was held, with the family physician and another consultant, and it was the unanimous opinion that the treatment should be continued. The following morning the patient had a profuse hæmorrhage which could not be controlled. She was given ether, and about two quarts of hydatidiform mole was removed from the uterus. In spite of the fact that the patient had had a general anæsthetic and had suffered the shock of an operation, two days later the phthalein output was 63 per cent. The patient was seen in consultation three months later, at which time there was some œdema of the face, the amount of urine passed in twenty-four hours was only 600 ccm. and contained albumin, but the phthalein output was 90 per cent.

CASE 98. Mr. P., age 26, was suffering with marked distention of the abdomen from ascitic fluid. An incapacitated surgical friend requested me to operate for him. He stated that a diagnosis of the underlying lesion had not been possible and he felt the patient should have the benefit of an exploratory cœliotomy. After examining the patient hurriedly a few minutes before the anæsthetic was administered, it was felt that he was a bad surgical risk. The phthalein output was 87.5 per cent. On opening the abdomen a carcinomatosis was found and the incision was rapidly closed. Three days after the operation he developed a mild coma which gradually became more marked until the beginning of the fifth day, when he succumbed. During the last forty-eight hours only 195 ccm. of urine was excreted.

In the two cases of carcinoma of the cervix uteri in which the phthalein output was 53 per cent and 72 per cent respectively, the death from uræmia in two months in Case 56, and in one month in Case 59 may have been due to pressure on the ureters from extension of the disease. This cause of the uræmia, however, did not apply to Case 69, as there had been a complete hysterectomy and there was no exudate in the pelvis, nor did it apply to Case 98.

In case 79, the hydatidiform mole with toxæmia, the phthalein test was never a reliable guide as to the condition of the patient. On admission, when she seemed in the gravest condition, the phthalein output was 66 per cent. Two days later, when there was every indication of a decided improvement, the phthalein output was 26.5 per cent. The improvement after the operation was not as marked as the phthalein output would indicate. The improvement was undoubtedly due to the source of the toxæmia being eliminated and to the free hæmorrhage. When seen in consultation three months later, because of a persistent bloody vaginal discharge, from what was diagnosed clinically chorio-epithelioma and confirmed by two independent pathological reports, the patient was not in a good condition; the kidneys were not functionally normal, but the phthalein output was 90 per cent.

CASE 34. Mrs. A., age 64, although a medical case, was on my service a few days and is included in the series. When admitted to the hospital she had almost continuous epistaxis and headache as a result of cardiovascular renal disease. The phthalein output was 33 per cent. Under rest in bed and appropriate treatment the bleeding ceased, the headache disappeared, and the patient seemed much improved and stated she felt decidedly better, but the phthalein output was only 26 per cent. Therefore, according to some authorities, the apparent improvement was a delusion. After being discharged from the hospital the treatment was carried out by the family physician. Eight months later, she called at the office and I was impressed at the marked improvement in her appearance, and she stated that she felt better than she had for years. The lower phthalein output after the decided improvement probably did not indicate anything more than the normal variation in the test. Had a third test been made a few days later it is possible that the output would have been greater than on admission. This could not be done, as the last test was made a few hours before she was discharged from the hospital.

In cases in which it is desirable to estimate the differential output for comparison, as in a suspected lesion of one kidney, the test should be applied several times, at intervals of two days, and the average taken, as one kidney may excrete a greater percentage one day and the opposite kidney a greater percentage at the next test and *vice versa*. If the functional activity of a kidney be based on only one application of the test, mistakes will occur frequently and may lead to unnecessary operations. In such cases, it will be safer to check up the results by other tests.

In some cases (Cases 19, 25, 34, 79, 91, and 92) the phthalein output after the patients had rested in bed with free evacuation of the bowels and increase in the ingestion of li-

quids, was less than on admission to the hospital; in other cases the output was greater.

Case 91 was one of interest. The patient was admitted to the hospital with a diagnosis of a left renal calculus. A stone was located in the ureter by the catheter and confirmed by the X-ray. The phthalein output on admission was 93 per cent. The patient was confined to bed and given large quantities of water and urinary antiseptics. One week later (and four days before the calculus was passed) the phthalein output was 38 per cent.

Two cases in the series, (41 and 46), with a phthalein output of 52 per cent and 56 per cent respectively, were refused operation, as they were considered bad surgical risks and had but little chance of securing even temporary benefit from operation.

SUMMARY

The dye appeared in the urine from five minutes to forty-two minutes, the average being ten minutes and eighteen seconds.

The average output for the first hour was 34.27 per cent, for the second hour 20.83 per cent, and for the two hours 55.1 per cent.

In 91.7 per cent of the tests the output was greater in the first hour. In 8.3 per cent of the tests the output was greater in the second hour.

In 20 per cent of the tests there was 4 per cent or less than 4 per cent difference between the output in the first and second hours.

Five cases, with the lowest phthalein output in the series, were subjected to major operations and had a normal convalescence.

Other cases with a much higher phthalein output had a complicated convalescence, with evidence of renal disturbances.

Case 56, with a phthalein output of 53 per cent, died of uræmia in less than two months.

Case 59, with a phthalein output of 72 per cent, died of uræmia in less than one month.

Case 69, with a phthalein output of 55.5 per cent, died in the hospital of uræmia fifty-two days after operation.

Case 98, with a phthalein output of 87.5 per cent, died in the hospital of uræmia five days after operation.

In some cases the phthalein output was less after the patients were placed in bed and the excretory organs toned up; in other cases the output increased.

In determining the functional activity of each kidney the test should be applied several times and the average taken. The result should then be checked up by other tests.

CONCLUSIONS

It does not seem possible to work out the minimum percentage phthalein output which will be safe to undertake surgical operations, nor is it possible from the phthalein test to determine what cases should or should not be subjected to operation. I believe it will never be possible to determine this point by any laboratory test, as the functional activity of a kidney varies under numerous circumstances and at different times.

In determining whether or not a patient should be subjected to operation, the history, clinical symptoms, and physical examination are of much greater value than any renal functional test yet devised.

The phthalein test used in conjunction with the clinical symptoms, history, and physical examination is of value. A small percentage output should put the surgeon on his guard and cause him to study the patient most carefully before undertaking an operation. The phthalein test should be used only as one of the many methods of investigation in ascertaining the condition of the patient.

THE CHRONIC ABDOMEN

A Review of Nineteen Cases of Pericolitis and Ileal Kink in which the Appendix had been Previously Removed

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THE term "acute abdomen" has a definite meaning. It is generally used to indicate an abdominal emergency, a crisis, such as perforation, hæmorrhage, or ileus. The exact cause of the condition may be obscure, but the first step in the treatment, and the last in the diagnosis, that is, exploratory laparotomy, is plainly called for, and effective treatment usually follows this initial step.

The term "chronic abdomen" is essentially different in many important respects. There is a confusing vagueness about the use and the meaning of the term; the etiology is unknown; the symptomatology varies greatly; treatment is not plain and simple: nonoperative has usually failed, laporatomy is not always indicated, and even after abdominal incision the cause of the symptoms may not be apparent. And finally the good result of any attempt at treatment is often only temporary. The acute abdomen calls for *mortality* tables, while the chronic abdomen calls for *morbidity* tables.

The "chronic abdomen" may be characterized by—

A. *Pain*, abdominal, usually on the right side, but may be on the left; may be very definitely localized or quite general; may be constant or periodic, often associated with hyperæsthesia or paræsthesia and without an increase in temperature. But the pain rarely demands morphine, and is often relieved by recumbency.

B. *Intestinal disturbance.* Constipation is usual, but may vary from most obstinate to normal bowel movements, or diarrhœa with colitis. Nausea and distress after eating, commonly spoken of as "indigestion or dyspepsia," and "gas" is common, vomiting rare.

C. *General symptoms.* Attributed by Lane and others to an "auto-intoxication": by Adami and others to "subinfection," are most characteristic accompaniments of the above pain and intestinal disturbance. They occur in great variety; for example, Lane presents the following rather formidable array of maladies, or abnormalities, due in his opinion to "auto-intoxication."

> Loss of fat; wasting of voluntary and involuntary muscles; alteration in the texture and color of the skin, with pigmentation and offensive perspiration. Subnormal temperature, especially affecting the extremities.
>
> Mental conditions of apathy, stupidity, or misery which may become exaggerated to a state of melancholia, or even apparent imbecility with suicidal tendencies.
>
> There may be neuralgic symptoms, neuritis, frequent headaches, loss of control of the temper, neurasthenia. Rheumatic aches and pains in muscle joints and skin. Atrophy of the thyroid gland; either increased or lowered blood pressure. Degenerative changes in the breasts. Prolapse of abdominal organs (partly because of loss of fat, partly because of loss of muscle), increased mobility of the kidney, prolapse and bends of the uterus. Breathlessness on exertion, at times of asthmatic type, due in some cases to a distention of the stomach and intestine. Degeneration of the heart muscle, with dilatation of left heart and aorta; and arteriosclerotic changes in the systemic arteries. Renal changes, "Bright's disease." Affections of the pancreas with chronic induration, inflammation, and finally cancer. Pancreatic diabetes. Infection of the biliary system, cholecystitis, cholelithiasis, cancer; with many acute and chronic diseases of the liver. Degenerative diseases of the eye.

A list, almost as long and comprehensive, of *indirect* results of "auto-intoxication," or chronic intestinal stasis, is also presented by Lane.

Some of the above, only one or many, will be found in every case of this character. To me the most strikingly constant and prominent have been the symptoms that may be called "nervous." The relation of these symptoms to the main abdominal complaints calls for elucidation on the part of the neurologist. The physical signs are few; there is pain and tenderness in the right side

of the abdomen, often in the right iliac fossa. Hyperæsthesia is many times characteristic. At times a dilated cæcum may be palpated, there may be gurgling on palpation of this region. The main point of tenderness may be in the region of the gall-bladder, the kidney, or the sigmoid.

With the exception of the above the objective symptoms may be characteristically and suspiciously negative. The X-ray may corroborate the very apparent clinical fact of delay in progress of the intestinal contents.

Etiology. The chronic abdomen has been attributed to various causes, at various times, in the evolution of abdominal surgery. For example: Ovarian—"neuralgia," cysts, adhesions; tubal—chronic salpingitis; uterine—"displacements"; appendiceal—"chronic appendicitis"; renal—floating kidney, Dietel's crisis; biliary—cholecystitis, calculous and non-calculous; duodenal—ulcer; gastric—ulcer, cardio- or pylorospasm; enteroptosis; lues—gastric crises.

The term "chronic abdomen" should be used to apply properly to cases in which the above enumerated conditions may be excluded. Treatment directed toward the cure of the above conditions has many times failed to give permanent relief to patients having more or less of the symptoms that are included under the caption "chronic abdomen," though they were for a time supposed to be the causative factor. The most recent explanation is the presence of intra-abdominal adventitious bands or membranes. Such adventitious bands may be found at various points within the abdomen, such as the terminal ileum (Lane), the ascending colon (pericolic of Jackson), hepatic flexure, duodenum and gall-bladder ("cobwebs in the attic of the abdomen," Morris), splenic flexure, and the sigmoid. These abnormal (or abnormal development of normal) bands or membranes may cause various manifestations of obstruction, from complete and acute, through chronic ileus, to an entire absence of symptoms, despite their marked development and demonstrable presence. The fact that such structures do exist without causing symptoms has given rise to great confusion as to their clinical significance.

In order to arrive at some definite understanding as to the etiological relationship between these bands or membranes and the symptoms complained of, it would seem advisable to review, as to the *remote* result, a series of cases in which the operative procedure was confined entirely to these structures, so that favorable results, if secured, might not be attributed to the removal or correction of coincidental pathological conditions.

I have therefore considered it worth while to present an analysis of a series of nineteen cases in which appendectomy had been previously performed, without permanent improvement, and in which at secondary operations these membranes or bands were found and an attempt made at their correction.

Study of these cases shows the following more or less important details:

Males	4
Females	15
Married	8
Single	11

AGES

Between 16 and 19	3
Between 22 and 29	6
Between 30 and 37	5
Between 40 and 43	5

The previous operation was for—

Interval operation for appendicitis	12
Removal of the appendix during the course of an operation for—	
Gastro-enterostomy for pyloric obstruction	1
Hysterectomy for fibroid	1
Cholecystostomy for calculi	1
Removal of ovary	1
Resection of ovary and round ligament shortening	1
Shortening of round ligaments	1
Removal of appendix and curettage	2
Removal of appendix with correction of pericolic membrane and ileal kink	2
Removal of appendix for acute inflammation followed by drainage	1
More than one operation before the conditions under consideration were corrected	3
Fæcal concretions found in the appendix at removal	3

The time between opertions was:

1 year	4	5 years	1
2 years	3	7 years	4
3 years	3	10 years	1
4 years	3		

In only one case was the primary operation performed for acute appendicitis, and this patient gave a history of many years of the complaints usually attributed to chronic

appendicitis. Between the operations the history showed acute colic demanding morphine in six; hyperæsthesia in nine; vomiting prominent in only four; jaundice in two; melancholia, two; menstrual irregularity, five; spoken of in the history as being "neurotic," ten; constipation absent in two; marked in all others; absent before and present after the first operation, two; palpable mass in the the right iliac fossa in seven.

At the second operation the following conditions were encountered:

Pericolic membrane, as described by Jackson	4
Pericolic membrane thicker	2
Pericolic membrane omental, as described by Flint	5
Pericolic membrane anterior mesogastrium, Harris	1
Double-barreled colon	7
Lane kink	6
Cæcum mobile	11
Cæcum mobile markedly thin and dilated	3
Cæcum mobile markedly thickened	2
Acute torsion of the cæcum	1
Enlarged mesenteric glands (not tubercular)	6
Omentum adherent to old scar	5
Appendiceal stump free from adhesions, in every case.	
Unusual localized chronic peritonitis of the terminal ileum	1
Marked thickening of the pericolic membrane between first operation (in which it was not disturbed) and the second	1
Re-formation of pericolic membrane after its removal	3

At the second operation the following procedures were carried out:

Division of pericolic membrane, plastic repair	13
Division of ileal band, plastic repair	7
Division of omental adhesions to abdominal wall	5
Division of perisigmoid adhesions, plastic repair	2
Separation of local adhesions of terminal ileum	1
Cæcopexy	7
Gastropexy	1
Fixation of hepatic flexure	1
Colectomy	1
Ileosigmoidostomy	1
Anastomosis between transverse colon and sigmoid	1

The right ovary was removed in one case, the gall-bladder drained (no stones) in two; curettage in one, and the rectum dilated in one.

While considering the question of treatment of this class of cases, it is no more than fair to mention two rather interesting cases that were treated by non-operative measures, and therefore because of the lack of demonstration of the condition may not positively be included in this group. But the clinical history leaves no reasonable doubt as to the similarity to the condition under consideration.

CASE A. Dr. W., male, 23, single, clerk. First operation for chronic appendicitis; prompt relief from symptoms for a year, then a return of same symptoms, for which an operation for stone in the kidney was performed. No stone found, but prompt relief for about a year, after which the same symptoms returned. I then examined him and advised against operation; but the patient went to another surgeon who performed laparotomy and divided some "adhesions on the colon." This was again followed by prompt relief that lasted for about a year. I examined him once more and again advised against operation, and put the patient to bed for a week, gave petrolatum, abdominal massage, and dietary regimen, which was followed by prompt relief which had persisted for six months up to the time of last report.

CASE B. F., 20, single, servant. Operation for chronic appendicitis, one and one-half years ago, no relief. Examination revealed a typical neurasthenic, with aerophagia, and hypersensitive abdominal scar, both of which disappeared with general improvement under appropriate non-surgical treatment.

The results are as follows: One case is too recent to be considered; seven cases have been markedly and satisfactorily relieved from the symptoms; eleven show no improvement. The primary result in all cases was dramatically favorable, but the symptoms began to return after the lapse of variable times, from a month to a year.

One would not be justified in drawing definite conclusions upon a subject so new, from cases so few as those in this series. The very common condition of over- or hyper-excitability in these cases would seem to call for a serious study of the visceral nervous system and neurological consultation before instituting operative procedure. Up to the present the neurologist has been silent upon this subject.

I would emphasize the necessity of awaiting remote results before drawing conclusions, as the immediate result is almost invariably very encouraging, and relapses far from uncommon.

CASE 1. June 3, 1910. B. L., female, nineteen years. *Previous operation:* Chronic appendicitis, curettage. *Interval:* three years. *Symptoms during interval:* Pain, hypersensitive right side; nausea; vomiting; fainting; amenorrhœa; constipation; neurotic loss of weight. *Condition found at second operation:* Omentum adherent to scar; cæcum and stump of appendix non-adherent; pericolic membrane, omental type. *Second operation:* Division of ad-

hesions and of pericolic membrane. *Result:* Improvement for a few months, then return of all symptoms.

CASE 2. May 22, 1911. C. D., female, eighteen years. *Previous operation:* Chronic appendicitis. *Interval:* One year. *Symptoms during interval:* Pain, hypersensitive right side of abdomen; nausea; vomiting; constipation; loss of weight. *Condition found at second operation:* Pericolic membrane, enlarged glands, ileal kink. *Second operation:* Division of bands and membrane, plastic repair. *Result:* Temporary improvement.

CASE 3. July 30, 1911. M. C., male. thirty-seven years. *Previous operation:* Acute appendicitis, drain, two years previous; ventral hernia, two years previous. *Symptoms during interval:* Right-side abdominal cramp, morphine; gas; vomiting; constipation; loss of weight; chronic invalid. *Condition found at second operation:* Pericolic membrane, ileal kink, cæcum dilated, atonic, no adhesions to site of appendix, omental adhesions to abdominal wound. *Second operation:* Division of membrane and band adhesions. Suspension of cæcum. *Result:* Marked improvement.

CASE 4. February 5, 1911. E. M., female, sixteen years. *Previous operation:* Chronic appendicitis. *Interval:* Four years. *Symptoms during interval:* Recurrent attacks of right-sided pain similar to those before operation; no constipation. *Condition found at second operation:* Ileal kink, no adhesions. *Second operation:* Division of band. *Result:* Marked improvement.

CASE 5. January 8, 1912. S. C., female, twenty-two years. *Previous operation:* Chronic appendicitis. *Interval:* Fifteen months. *Sypmtoms during interval:* Improvement for three months, then return of symptoms. At present symptoms of acute ileus. *Condition found at second operation:* Pericolic membrane, cæcum mobile, torsion of cæcum, no adhesions. *Second operation:* Division of pericolic membrane, suspension of cæcum. *Result:* Marked improvement.

CASE 6. January 11, 1912. Dr. L., male, forty years. *Previous operation:* Chronic appendicitis. *Interval:* Ten years. *Symptoms during interval:* Constipation; pain, tenderness, and gas, right-side abdomen. *Condition found at second operation:* Double-barrel-shotgun colon, pericolic membrane, omental type; ileal kink, cæcum mobile, thin and dilated; no adhesions to appendix stump. *Second operation:* Division of membrane and band, suspension of the cæcum. *Result:* Marked improvement.

CASE 7. February 13, 1912. P. J. G., female, thirty years. *Previous operation:* Chronic appendicitis, seven years; exploratory, six years; cholecystostomy, three months. *Symptoms during interval:* Pain, tenderness, palpable mass right iliac fossa, constipation, nausea, and vomiting, chronic invalid, neurotic, floating kidney. *Condition found at second operation:* Enteroptosis, cæcum mobile, pericolic membrane, no adhesions. *Second operation:* Division of membrane, cæcopexy, dilatation of rectum. *Result:* Prompt return of symptoms, May 12. Fixation of kidney, August 13; nephrectomy right. At present similar pain left side, and but little general improvement.

CASE 8. April 20, 1912. A. W., female, forty-eight years. *Previous operation:* Chronic appendicitis. *Interval:* Five years. *Symptoms during interval:* Constipation; myofibroma of uterus. *Condition found at second operation:* During abdominal hysterectomy found site of appendix free from adhesions; ileal kink. *Second operation:* Division of ileal band. *Result:* Marked improvement.

CASE 9. June 25, 1912. Mrs. Bk., forty-one years. *Previous operation:* Chronic appendicitis. *Interval:* Seven years. *Symptoms during interval:* Pain, tenderness, nausea, vomiting, colic, mass in right iliac fossa, constipation, extreme. *Condition found at second operation:* Localized chronic peritonitis of the terminal four feet of ileum; convoluted bowel covered by parchment-like fibrous tissue forming a ball which at first was thought to be malignant. *Second operation:* Separation of adherent ileum, September 16, 1912; ileosigmoidostomy, October 15, 1912; enterostomy for acute ileus, June 2, 1913; separation of adhesions, entero-enterostomy. *Result:* No improvement.

CASE 10. November 27, 1913. C. H., female, twenty-five years. *Previous operation:* Chronic appendicitis. *Interval:* Two years. *Symptoms during interval:* Attacks of right-sided pain, nausea, vomiting, and constipation. *Condition found at second operation:* Ileal kink. *Second operation:* Separation of ileal band. *Result:* Marked improvement.

CASE 11. May 12, 1913. M. Sk., female, thirty-seven. *Previous operation:* Gall-stones; appendectomy; pericolic membrane not disturbed, November 15, 1911. *Symptoms during interval:* Constipation, gastric distress, right-sided pain and tenderness, loss of weight, melancholia. *Condition found at second operation:* Cæcum mobile, extreme messenteric glands, pericolic membrane, had become much more thick and leathery; double-barrelled colon; omentum not adherent to cæcum or site of appendix. *Second operation:* Separation of membrane, cæcopexy. *Result:* Slight improvement.

Case 12. December 6, 1913. H. Wch., female, twenty-seven years. *Previous operation:* Chronic appendicitis. *Interval:* Two years. *Symptoms during interval:* Same pain on right side as before operation but of late pain and tenderness left iliac fossa, constipation. *Condition found at second operation:* Perisigmoidal adhesions, cæcum mobile. *Second operation:* Division of perisigmoidal adhesions. *Result:* Marked improvement.

CASE 13. February 12, 1913. Anna N., thirty-two years. *Previous operation:* Removal of appendix, right ovary, seven years ago. *Symptoms during interval:* Pain, hypersensitiveness, constipation, gas, nausea, vomiting, loss of weight, melancholia. *Con-*

dition found at second operation: Mid-line ptosis, pericolic membrane, mesenteric glands, omental adhesions to abdominal wound, caput cæcum free from adhesions. *Second operation:* Coffey hammock operation, fixation of the cæcum, December 19, 1913; colectomy, ileosigmoidostomy. *Result:* Considerable improvement with gain of fifteen pounds for five months; then return of all symptoms.

CASE 14. January 26, 1913. C. H. J., female, forty years. *Previous operation:* Plastic resection of right ovary, appendectomy, short round ligaments. *Interval:* Four years. *Symptoms during interval:* Right side always painful, tender, gas, constipation, vomiting absent. *Condition found at second operation:* No adhesions of ovary or caput cæcum. Cæcum dilated and markedly movable. Double-barrel colon, omental pericolic membrane directly continuous with fundus of gall-bladder, typical of condition described by Harris (J. Am. M. Ass., April 18, 1914). *Second operation:* Divided membrane and extension of gall-bladder. Fixation of cæcum. Removed right tube and ovary. *Result:* No improvement.

CASE 15. February 5, 1914. A. D., female, twenty-seven years. *Previous operation:* Appendectomy, curettage. *Interval:* Two years. *Symptoms during interval:* Pain, tenderness right side; mass in iliac fossa; gas; constipation; frequent and painful urination. *Condition found at second operation:* Site of appendix non-adherent, marked cæcum mobile, dilated, thickened wall, leather-like pericolic membrane. *Second operation:* Division of pericolic membrane. *Result:* Temporary improvement for four months, then return of original complaint.

CASE 16. March 9, 1914. A. S., female, twenty-seven years. *Previous operation:* Chronic appendicitis. *Interval:* Seven years. *Symptoms during interval:* Right-sided colics, diagnosed as biliary. *Condition found at second operation:* Omentum adherent to abdominal wound. Appendix stump free from adhesions. Omental pericolic membrane. Hepatic flexure absent. *Second operation:* Division of adhesions, and of pericolic membrane. *Result:* Five days after operation symptoms of brain tumor diagnosed "polio encephalitis." Abdomen negative for two months, then return of same attacks. Diagnosis, hysteria.

CASE 17. January 15, 1914. Mrs. S., female, thirty-three years. *Previous operation:* Chronic appendicitis, round ligament shortening. *Interval:* Two and one-half years. *Symptoms during interval:* Pain, tenderness right and left lower abdomen; leucorrhœa; palpable mass, right side, gastric distress, constipation. *Condition found at second operation:* Sigmoid adherent to left broad ligament; no omental adhesions; double-barrelled colon; omental pericolic membrane; cæcum mobile, dilated, and thickened. *Second operation:* Division of adhesions and of pericolic membrane. *Result:* No improvement.

CASE 18. March 10, 1914. V. F., male, twenty-nine years. *Previous operation:* Chronic appendicitis, ileal kink, pericolic membrane thick, October 3, 1913. *Symptoms during interval:* Right-sided colic, severe; nausea, vomiting; constipation, which was absent before operation; jaundice. *Condition found at second operation:* Omentum adherent to abdominal wall; site of appendix, end caput; cæcum free; a new pericolic membrane thinner and vascular had formed; omentum attached to gall-bladder and hepatic flexure; mesenteric glands; terminal ileum attached to anterolateral abdominal wall. *Second operation:* Separation of adhesions and membrane; cholecystostomy, no stones. *Result:* No improvement.

CASE 19. April 25, 1914. Mr. D., male, age 48. *Previous operation:* Gastro-enterostomy, 1903; second gastro-enterostomy for jejunal ulcer, 1907; resection of pylorus, gastro-enterostomy, appendectomy, mucocele, ileal kink, March 12, 1914. *Symptoms during interval:* Constipation; attacks of pain, right side; nausea, vomiting; mass in right iliac fossa; exaggerated peristalsis. *Condition found at second operation:* Obstruction of transcolon, with dilated transverse colon in right iliac fossa. Omentum adherent to abdominal wall, none to cæcum. No recurrence of ileal kink. *Second operation:* Anastomosis between transverse colon and sigmoid. *Result:* Too early.

SOME CONSIDERATIONS WHICH DETERMINE THE EXTENT OF AN OPERATION IN SEPTIC INVASION OF THE LATERAL SINUS[1]

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I DO not commence an operation with the fixed idea that the venous channel must be obliterated, its lumen exposed, and, as far as possible, its walls excised from the torcular herophili to the junction of the jugular vein with the innominate; nor, on the other hand, do I say to myself, "All that is necessary is to plug up the sinus for an inch or two after removing the clot." The conditions found are so varied that the maximum operation may in one case be as futile as the minimum, in another the minor as successful as would have been the major, while in a third the maximum operation would appear to give the best if not the only chance of recovery. For this reason also it seems to me that collected statistics are particularly baffling and of little value as a general guide to the extent of the operation required in an individual case. My own experience—contrary, I fear, to the expectation of the gentlemen who have honored me by asking me to read a paper on this subject—is comparatively small (about 30 cases), but, if small, it has been fairly varied; therefore I propose, not to analyze figures, but to give my conclusions as to the best methods of dealing with such conditions as it has been my fortune to recognize. I have also, in answer to set questions, obtained from twenty-five British otologists practicing outside London expressions of opinion, based on their own experience, on varied points of interest. These answers have been tabulated and analyzed, and I have included in the tabulation at the end of this paper the result of this analysis as taken from the actual replies, or the substance of the replies, received. Many of these replies are of great interest, and I take this opportunity of publicly thanking those gentlemen who have kindly sent them for the great interest they have shown and the trouble they have taken.

FACTS WHICH INFLUENCE THE EXTENT OF THE OPERATION BEFORE THE OPERATION IS BEGUN

Let us consider for a moment the anatomical and pathological possibilities of extension of infection or of the actual clot from a given focus. I have recorded a case of metastatic abscess near the shoulder in a simple streptococcal acute otitis media without bone disease or sinus thrombosis.[2] Such cases, and cases of temporal bone pyæmia without thrombosis of the sinus, do not come strictly within the scope of this discussion, but they have to be taken into account because they may present systemic symptoms similar to those of true sinus thrombosis. The rare cases of primary septic thrombosis of the petrosal sinus or a persistent petrosquamosal sinus may also give early pyæmic symptoms without at once causing thrombosis of the lateral sinus or bulb. It follows that systemic symptoms with or without labyrinthine disturbances and without any local signs of bone infection should receive the utmost consideration with regard to the necessity for local surgical measures.

Coming to the common mode of infection—caries of the wall of the sulcus lateralis or of the jugular bulb and perisinus abscess—we find that we have in the majority of cases a more regular progression of events; this progress being interrupted at various stations for a shorter or longer period according to the anatomical features, the virulence of the infection, and the resisting power of the patient. A perisinus abscess may exist for a considerable period before the wall of the sinus succumbs, and may even discharge itself through the fistula formed in the posterior wall of the mastoid without having invaded the sinus. When the sinus wall is penetrated and a clot forms, the process

[2] Brit. M. J., 1906, ii.

[1] Read before the Clinical Congress of Surgeons of North America, London, July 29, 1914.

may be arrested at the jugular foramen in one direction and at the entrance of the superior petrosal sinus in the other, a firm clot with a small central abscess being the result. Such a case as this has been known to undergo spontaneous cure by the discharge of the abscess through the sinus wall and the fistula in the mastoid wall.

Tracing the progress backward, when the clot reaches the horizontal sinus there is nothing to prevent its extending to the torcular herophili or small fragments being carried by the backwash into the torcular herophili; and once there, the progress of the infection to the other great sinuses is easy. This question of extension to the opposite sinuses has not received the attention it deserves in literature. I reported a case of infection of the opposite lateral sinus as long ago as 1893[1] and at later dates two other cases, one of which had a large abscess in the occipital and temporosphenoidal lobes of the opposite side. My first two cases died; the third, in which the local signs were limited to extreme tenderness along the course of the internal jugular vein, recovered after a long illness, without operation on the opposite sinus or vein. Mr. A. L. Whitehead[2] recorded a case in 1907 which recovered, and Mr. C. E. West in discussing the case referred to one in which he tied both internal jugular veins, the patient dying from purulent meningitis. Mr. S. Lodge[3] in 1900 published an obscure case which was shown at post-mortem to have thrombosis of both lateral sinuses. Voss[4] in a recent paper lays particular stress on backward extension and the means of preventing it. I think this extension is a possibility which is occasionally overlooked, and it is not unlikely that operations in the wrong direction are sometimes performed with the object of arresting systemic infection. *When the sigmoid sinus is firmly clotted*, extension downward appears to me less likely to happen than in a backward direction: at one end there is the narrow jugular foramen occasionally crossed by fibrous septa[5] with the curved recess beyond it into which the end of the clot would first be carried; at the other end a wide unobstructed sinus. I conclude, therefore, that extension downward, if it takes place at all, does so before the sigmoid clot is fully formed, or after disintegration has set in, or when a half-formed or breaking-up clot is disturbed by operation or sudden movements of the head and neck. Such conditions, i. e., the presence in the sinus or vein of septic fluid or semi-fluid contents, urgently demand immediate ligation and excision or free opening of the vein. When either primarily or secondarily a firm clot has formed in the bulb or in any part of the vein above the common facial, a temporary arrest of its progress may occur either at the exit from the bulb, with complete collapse of the walls of the upper segment of the vein, or just above the level of the common facial vein; but once it has come under the influence of the facial vein its extension or propulsion downward can only be arrested by a ligature or absolute rest in the dorsal position.

There are thus five stations at which the natural progress of infection may be arrested temporarily; viz., at the sinus wall, at the superior petrosal sinus, at the entrance into the bulb, at the exit from the bulb, and finally, at the junction of the facial vein. It is for the surgeon to determine what stage has been reached at the time of operation. Whether it is possible to limit the extent of the operation accordingly will depend on the virulence of the process and the clot-forming and germ-resisting power of the individual's blood.

There is one direction of extension which we have not yet considered; viz., along the petrosal sinuses to the cavernous sinus. This is, in my opinion, a comparatively rare occurrence. I have not seen it in the course of a case which began as lateral sinus thrombosis. It has to be considered in relation to ligation of an internal jugular vein which contains a mural or a disintegrating thrombus, in relation to the question of irrigation of the vein or sinus, and in relation to the question of the necessity for the complete exposure of the jugular bulb. Two of my correspon-

[1] Brit. M. J., 1893, ii, 563.

[2] Proc. Roy. Soc. Med., ii, Otol. Sec., 1.

[3] J. Laryngol., Rhinol. & Otol., 1900.

[4] Deutsche Ztschr. f. Chir., 1913, p. 375.

[5] Jones, Hugh E., Brit. M. J., 1906, ii.

dents altered their practice with regard to ligation of the vein because they believed that ligation had caused immediate invasion of the cavernous sinus.

My own opinion is that a septic infection of the cavernous sinus will not readily arise without interference, because of the narrowness of the superior petrosal sinus and its proximal situation in relation to the focus of infection; and because the inferior petrosal sinus is largely protected by its valvular entrance into the lower end of the bulb[1] or upper end of the vein. This valvular entrance however, is no protection against a return flow of septic blood from the vein, or from irrigation from vein to sinus. The vein, if tied, should therefore be also excised or opened at once (after occlusion of the proximal end of the sinus) when the contents are more or less fluid; and if irrigated, the process should be carried out from sinus to vein.

The much-discussed anatomical variation whereby one lateral sinus is made to do nearly all the work of two claims some consideration.[2] None of my correspondents have referred to the matter, and I have no personal experience of this variation. In the case referred to above, in which both sinuses were completely occluded, there was great engorgement of the veins of the scalp, and a congeries of veins had formed around the mastoid vein on the side originally diseased. As this patient died from temporal sphenoidal abscess of the opposite side, and toxæmia, I have no reason to suppose that the circulatory difficulty could not have been overcome. Whitehead's case quoted above also proves that the circulation may be reëstablished. The occurrence of a rudimentary sinus on one side is admittedly rare; Linser puts it as three per cent, and there can be no doubt that by the time the necessity for ligation of the internal jugular vein arises, especially in sinus thrombosis, compensatory collateral circulation has been to some extent established. *When the need for ligation is a real one* the risk of ligation must be taken, but if possible the facial and external jugular veins should always be spared.

[1] Jones, Hugh E., Brit. M. J., 1906, ii, 1376.

[2] For full discussion of this question and collected cases *vide* "Circulatory Disturbances following Ligation of Internal Jugular Vein." Wells P. Eagleton, M. D., Arch. of Otol., 1906, xxxv, No. 2.

COMPLETION OF THE DIAGNOSIS DURING THE COURSE OF THE OPERATION

The first necessity in treatment is a complete diagnosis before or during the early stages of the operation, so that all that is necessary to be done may be accomplished at the time, without recourse to a second operation. This, of course, is not always possible, but it is the thing to aim at. As has often been said, the existence of a thrombus does not in itself cause systemic symptoms; in fact, it may prevent them. On the other hand, general pyæmic symptoms in themselves do not prove the existence of a thrombus, nor do swelling and pain in the neck. It is necessary, therefore, in nearly all cases to expose the sinus at the first (or counting the mastoid operation as the first stage, at the second) stage of the operation. The only admissible exception to this rule appears to be when the disease has existed for several days, lung metastases are present, and rigors are frequent. In such a case the clot is probably in a state of disintegration; and a rapid exposure, ligation, and opening of the vein may save valuable time. Having thoroughly cleared out the mastoid and opened the groove of the sigmoid sinus, and finding there a perisinus abscess with granulations covering the sinus, or any departure from the normal appearance of the sinus, bone should be removed in both directions without disturbing or even touching the sinus more than is absolutely necessary until at least half an inch of healthy wall is exposed, if possible, at both ends of the diseased area. Several of my correspondents say that there are no reliable indications of the condition of the intima, or of the character of the contents of the sinus, prior to an exploratory incision or aspiration. With this I cannot agree. My experience is that healthy granulations and pus, in the absence of a history of repeated rigors, vomiting, and oscillating temperature, indicate a sound intima and fluid blood. The absence of granulations over any part of a sinus which has not the healthy bluish-white, semi-translucent, normal appearance indicates infection of the intima and either solid or mural thrombus. A thickened discolored wall with severe systemic symptoms,

at an early stage means mural clot; at a late stage, after a comparatively quiescent period, disintegrating clot; mild systemic symptoms with partial collapse and a sloughy wall at one point, the localized breaking down of a solid thrombus. If the focus of disease is in the tympanum or anterior part of the antrum, with normal appearance and pulsation but increased distention of the sigmoid sinus, and if there is pain, tenderness, and stiffness of the neck and presence of systemic symptoms, the diagnosis is primary clotting of the bulb. These, and other indications given by some of my correspondents, seem to obviate in the great majority of cases the necessity for palpation or exploratory aspiration of the sinus. Incision should, in my opinion, be made not so much as an exploratory procedure but as a continuation of the operation and with the necessity for obliteration of the sinus in one's mind. This being so, I expose the sinus until nearly an inch of healthy wall is uncovered on the torcular side and compress it there with a plug of gauze between dura and bone. If, after following the sinus down toward the jugular foramen, no healthy wall is reached, or if there is any doubt about the condition of the bulb and vein and the systemic symptoms have been severe, I expose the internal jugular vein at the junction with the common facial. Hitherto having exposed the vein I have invariably dealt finally with it.

In the future I shall expose the vein as one exposes the sinus—for inspection, and not necessarily for obliteration. This was suggested to me by Voss's paper[1] and by my correspondent, Mr. George Wilkinson of Sheffield, who lays great stress on the valuable information as to the condition of the bulb and sinus obtained by exposing the vein. When he does not find it necessary to tie the vein at once, Voss introduces two provisional ligatures formed of strips of gauze around the vein, leaving the wound open so that the ligatures may at any time be tied, without an anæsthetic and in the course of an ordinary dressing. This provisional ligature does not seem to me very important, but the principle of exposing the vein for inspection, and the information which may be got thereby, appears to be a distinct advance.

[1] Voss, loc. cit

Having made the diagnosis as complete as possible by consideration of systemic symptoms, the probable source of infection, inspection of the sinus, and if necessary of the internal jugular vein, we are in position to decide on the extent of operation required and to complete it at once. (I have said nothing about blood-counts, lumbar puncture, and bacteriological investigations because they do not seem to have any important influence on the extent of the operation—at any rate, of the first operation; after this, they may afford valuable information leading to further operation or to the employment of suitable vaccines.)

CONCLUSION

In every case of temporal bone disease with symptoms suggesting the presence of a perisinus abscess or the onset of pyæmia, expose the sigmoid sinus with the least possible disturbance to its walls until healthy wall is seen and the blood in the part is judged to be fluid and the lumen controllable. This may involve removing bone up to, or even including the covering of the torcular herophili, and down to within reach of the jugular foramen. If no disease is apparent except the extradural abscess and the so-called "healthy" granulations springing from the sinus wall, and if only one rigor has been observed—wait. If the pyæmia is established but not severe and there is a limited occluding clot in the sigmoid, compress above and below clot, remove clot, excise outer wall between the compresses, and pack with gauze. If the sinus is obviously diseased, but contents are partly fluid and systemic symptoms marked, expose internal jugular vein in neck. Even if sinus is *not* obviously diseased, and the blood is fluid, and there is severe pyæmia or symptoms of bulb-thrombosis, expose internal jugular vein, occlude both sinus and vein, drain, and plug the intervening part. If the sinus is clotted and the lower limit of diseased wall or clot cannot be reached, expose the vein in the neck—this is merely applying the principle of exposing healthy wall beyond each end of the clot, without undertaking the much longer and generally un-

necessary operation of exposing the bulb. Having laid bare the internal jugular vein at the entry of the common facial vein, we have several courses to consider. If the vein is of normal size and looks healthy, and if blood is flowing freely through it, compress temporarily and remove the clot from the sinus down to the jugular foramen; if there is a free flow of blood into the sinus, plug the sinus after draining, and either close the neck wound or put in Voss's provisional ligatures, according to the severity and duration of the systemic symptoms. If the vein is collapsed above the facial, but healthy and full of fluid blood below, tie in two places and divide above the facial, bring the upper end into the wound, and endeavor to clear out the clot from the bulb by gentle irrigation. The same procedure can be adopted if the upper vein is clotted, but the clot does not reach to the facial vein and the lower vein is healthy. It is easier to clear the bulb under these circumstances than to do so when the vein is collapsed.

When the clot extends beyond the facial junction it is better, in my opinion, to tie and divide the internal jugular as low down as possible in the neck. In one case where I had tied the vein below but near the facial, everything was going on well when, two or three days after, the patient got out of bed, in the temporary absence of the nurse, with a rapidly fatal result. The presumption is that a healthy clot from the lower vein was dislodged and was carried into the heart.

Having dissected up the vein and tied off the tributaries, including the facial, I excise the greater part and bring the upper end into the wound. There is always a temptation to leave the vein unopened the first day, for fear of severe hæmorrhage, but the risk of extension of sepsis from the upper vein is too great, and drainage from sinus to vein should be established at once. As I have already pointed out, the danger of irrigation downward is slight, owing to the valvular opening of the inferior petrosal sinus. The wound in the neck may be closed, except the upper inch, without packing, unless the walls of the vein are diseased, though the danger of suppuration along the trachea is a real one. In one case upon which I operated, but in which the after-treatment was not in my own hands, suppuration took place with perforation of the trachea and a fatal issue. I have no experience in resection of the clavicle, or of any attempt to deal with the subclavian or innominate veins. I have never tied both internal jugulars, nor have I explored both lateral sinuses in the same case. Both of these operations, however, appear to be within the bounds of practical surgery. Associated cerebral and cerebellar abscess, meningitis, and metastatic abscesses must, of course, be dealt with as occasion demands.

ANALYSIS OF ANSWERS FROM TWENTY-FIVE OTOLOGISTS AND GENERAL SURGEONS

The following questions were sent to British surgeons, and an analysis of the answers from twenty-five otologists and general surgeons is given below.

OTITIC SEPTIC SINUS THROMBOSIS

As the result of your own personal experience —

I. Which would you do first — tie the internal jugular vein or expose the sigmoid sinus?

a. When one rigor has occurred and there is some pain and stiffness of the neck without other signs of vein involvement.

b. When rigors have been repeated and other classical symptoms have been present for several days, but there are still no local signs of the jugular vein being affected.

c. Where there are local signs of vein thrombosis.

II. Supposing the sinus to have been exposed in condition I *a*, perisinous abscess found, and the sinus wall thickened and covered with granulations — would you explore the sinus at the same operation, and if so, how? Would you tie the vein before exploring the sinus?

III. Do you think it is ever advisable or justifiable *not* to tie or excise the vein in conditions I *a*, *b*, *c*? Have you any strong views based on actual experience for or against tying the vein at all in any of the above conditions?

IV. What do you consider to be the best indications before opening the sinuses?

a. Of absence of clot.

b. Absence of endosinusitis.

c. Mural septic clot with permeable sinus.

d. Primary clotting in the bulb of the jugular vein.

V. Do you employ any special method to determine the extent of clotting; e. g., palpation, fluctuation from vein to sinus, or tuning-fork auscultation, and with what result?

VI. Technique of operation:

1. How do you deal with the torcular end of the sinus?
2. How with the distal end when the vein has not been tied?
3. Where do you tie the internal jugular vein?
4. Do you excise a portion or the whole of the vein?
5. If you do not excise, how do you treat the divided vein?
6. Do you irrigate sinus and vein?
7. If vein is excised, what drainage do you employ?
8. What is your experience of suppuration along the great vessels?
9. Do you consider that it is necessary under any condition to expose the bulb?

10. Have you ever ligated both internal jugular veins or explored and obliterated both lateral sinuses? If so, what was the result?

11. Have you ever found it necessary to resect the clavicle or tie the vertebral vein?

Answers to the above questions were received from the following otologists and general surgeons:

Logan Turner, Edinburgh; W. S. Kerr, Sheffield; D. R. Paterson, Cardiff; Wilfred Clegg, Birmingham; Adair Dighton, Liverpool; J. S. Fraser, Edinburgh; J. A. K. Renshaw, Manchester; Harold Mole, Bristol; A. L. Whitehead, Leeds; Sir Robert Woods, Dublin; Albert Gray, Glasgow; George Wilkinson, Sheffield; T. O. Graham, Dublin; McKenzie Booth, Aberdeen; Watson Williams, Bristol; E. M. Stockdale, Liverpool; Constable Hayes, Leeds; W. Permewan, Liverpool; W. T. Clegg, Liverpool; H. A. Ballance, Norwich; W. S. Syme, Glasgow; A. D. Sharp, Leeds; K. W. Monsarrat, Liverpool; Samuel Lodge, Bradford.

I *a*. Twenty-two expose sinus only, without exploring it. Two explore sinus, then tie the vein. One ties the vein, then explores sinus.

b. Two always explore and slit up sinus only. Four expose sinus, then tie vein. Thirteen explore the sinus and then tie vein if necessary. One exposes the vein for information. Five tie the vein first, then explore the sinus.

c. One explores sinus alone. One explores sinus; then opens the vein, if clotted, without ligating it. Eight explore sinus first; three of these tie vein occasionally, five tie vein always. Fourteen tie vein first.

II. Two never explore sinus at first operation. Eighteen expose sinus, and wait or act according to findings. Five, if intending to explore sinus, tie vein first. Six do not tie vein first, and four are doubtful.

III. I*a*. Nineteen consider it justifiable *not* to tie. One thinks it is never justifiable not to tie the vein.

I *b*. Seven think it sometimes justifiable *not* to tie vein. Five never justifiable. Two never tie the vein.

I *c*. Twelve think it never justifiable *not* to tie vein. Two never tie the vein.

IV. *a*, *b*, and *c*. Eleven give no answer or say there are no trustworthy signs. Nine employ palpation of the sinus with or without fluctuation from vein to sinus. Most rely on color, distention, pulsation, density of contour of wall, and presence or absence of systemic symptoms.

d. Answers too varied to classify. W. S. Kerr: Delayed rigors with septic temperature chart, labyrinthine symptoms, tenderness between the jaw and mastoid. J. S. Fraser: Great bleeding during mastoid operation from bone and emissary veins. Knowles Renshaw: healthy sinus; no fluctuation in sinus when pressure applied along vein. Hamilton A. Ballance: Pyæmia with absence of disease about the sinus. W. S. Syme: Temperature chart, rigors, absence of upward flow into sinus. G. Wilkinson: Indications got from exposure of vein in the neck. E. M. Stockdale: Thrombosed sinus with healthy mastoid. Constable Hayes: Pain on swallowing referred to tonsillar area, associated with mastoid symptoms. T. O. Graham: Early stiffness of neck and no marked local signs around sinus at operation.

V. No mention is made of tuning fork auscultation nor of absence of "bruit de diable."

VI. 1. Six drain, then plug the lumen if bleeding. Two incise, fold walls in, and pack. Eight use gauze pressure pads, and one uses rubber sponge. Twelve remove clot until blood comes. One leaves it alone.

2. Eight plug the lumen. One folds in walls and packs. Four use gauze pressure pads. Five remove clot until blood comes. Four leave alone.

3. Nine above the facial vein if there is no clot below. Eight "below the clot." Six always below the facial vein. Two at "root of neck." Two opposite thyroid. Two opposite cricoid.

4. Thirteen excise none. Two, all. Two, "as much as possible, when clot present." Five, "diseased part." One, remainder after stitching upper end in the wound.

5. Four double ligature, divide vein, and leave in wound. Sixteen double ligature, divide, and fasten upper end in wound. One inserts tube and gauze in vein (upper end). One uses Ballenger's stab-wound method. One "packs it." Three open vein freely *in situ*.

6. One sinus only. One sinus and vein separately. Nine through from sinus to vein. Ten do not irrigate. Four sometimes irrigate.

7. Three, gauze. One, split rubber tube. Three, gauze within rubber tube. One, iodoform worsted. Several did not reply.

8. Ten had never seen it. Four considered it dangerous. One thought it rare, if vein brought out of wound. One had only a small localized abscess. Three said it was easily cured by drainage.

9. Seven, "No." Two, "if bulb thrombosed." One thought it might occasionally be necessary, but had not done the operation. Five, when symptoms continue after complete treatment of vein and sinus. Two when irrigation fails. Four when extradural abscess invades jugular fossa.

10. One (only) *patient recovered* (Whitehead, Proc. Roy. Soc. Med., ii. Otol. Sect., 1.)

11. Nil.

POLYCYSTIC KIDNEY[1]

By CHARLES E. BARNETT, M. D., F. A. C. S., Fort Wayne, Indiana

In a former paper upon this subject, before this association, the writer endeavored to show that our statistics were insufficient to cover the subject of unilateral [2] polycystic kidney. A number of opinions were given to show the divergent views entertained regarding the etiology and pathology of the disease. An operative case was reported, thus showing the logic in operative procedure rather than non-operative as recommended by most authorities.

This paper endeavors to cover thoroughly the numerical, diagnostic, and prognostic statistics of the subject in the United States. The writer knows that there are some omissions, but thinks that the commissions, where the number of cases are overstated by pretenders, will equalize the omissions. Quite a number of cases were rejected on account of their unreliability.

One of the factors that adds to the difficulties of a differential diagnosis between unilateral and bilateral disease is the astonishingly small amount of true kidney substance that is required to sustain life.

The fact that the remaining kidney cannot be cut into during the operation in order to prove it to be non-pathologic at that time, and considering the maze of mystery and doubtfulness concerning the etiology of the disease, makes an absolute diagnosis impossible; for, should we consider the cause (outside of fœtal tubular misalignment) a block of the uriniferous tubules or chemical changes, such as arsenic or aniline dye poisoning brings about, or the involvement of the renal lymphatics, these changes could readily occur following the nephrectomy when one considers that a double load is placed upon the remaining kidney with the same economy working that had produced polycystic changes in the other kidney.

It was naturally quite impossible to get detailed histories from any great number of cases, because of the number of years covered by the operators and the inaccessibility of case records even when case reports had been kept. The interest that the majority of the ablest men working in that line of surgery manifested by their letters explaining certain phases of their case reports, indicated to the writer's mind two facts: First, that the subject needs more investigation; second, that the conscientious worker, no matter how busy, is ready and anxious to give his assistance in such an investigation.

The whole number of polycystic kidney cases reported and considered authentic was 251: bilateral, 150; unilateral, 101;[3] of this number, 9 unilateral cases were still living, 104 had operative recoveries, and 58 died.

The first choice in nomenclature was "polycystic kidney"; second choice, "congenital cystic kidney."

Congenital defects, associated with cysts of the liver, etc., were reported as follows: One cystic goiter; two cysts in breast; one liver was nodular; one case was associated with cysts of liver and spleen. Heredity was a factor in four cases; infection was present in thirty-one; mixed infection in eighteen; colon bacilli in seven; tuberculosis in five; pneumococci in one.

Visceral ptosis was present in eight; arteriosclerosis in eight; uræmia in seventeen; dysuria in eighteen; hæmaturia in twenty-two; polyuria in twenty-five.

In the urinalysis the specific gravity was low in 15 cases, high in 10; the lowest specific gravity was 1002; highest, 1030. Albumin was found in 24; casts in 12. Four were normal.

The most frequent predominant symptom was tumor, in 23 cases. Other symptoms suggested were: Pain, 20; polyuria, 6; uræmic coma, 5; hæmaturia, 6; anuria, 4; backache, 3; general *malaise*, 2; ptosis, 2; toxæmia, 16.

[2] "Unilateral polycystic kidney" is designated when the surgeon has, by palpation, functional test, etc., proved according to his best judgment that the other kidney is free from cysts.

[3] Three hundred and forty-nine cases were reported on first card: 187 bilateral and 162 unilateral; 45 cases (34 bilateral, 11 unilateral) were excluded on account of not responding to second card proof; 53 cases (3 bilateral and 50 unilateral) were thrown out as coming from pretenders; 251 cases (150 bilateral and 101 unilateral), proved by second card system for some details, were the ones considered as authentic.

[1] Read before the American Urological Association, Philadelphia, June 20, 1914.

Thirty-seven males and 54 females were reported. The youngest was 5 years; the oldest, 76 years. One case was reported as congenital in fœtus. The disease occurred most frequently between the ages of 40 and 50; average age, about 41½ years.

The following is a list of ages of patients in which polycystic kidney occurred:

UNILATERAL		BILATERAL	
No. of Cases.	Age, Years.	No. of Cases.	Age, Years.
1	76	1	75
		2	65
2	60	2	60
		1	59
		1	55
		1	51
1	50	9	50
1	49		
		1	48
		1	47
		1	46
		1	45
1	44	1	44
1	43	1	43
2	42		
		1	41
2	40	4	40
1	39		
3	38	3	38
1	37		
		3	36
4	35	3	35
3	34		
		2	33
		2	32
2	30	2	30
2	20	1	29
3	16	1	28
		1	5

When unilateral, the differential diagnosis was made in —

Five cases by exploratory incision;
Seven cases by cystoscopy and ureteral catheterization, with functional kidney tests;
Fourteen cases by the irregular outline of the large kidney;
Six cases by abdominal section;
One case by the X-ray;
Five cases by autopsy.

The men reporting cases are as follows:

	No. of Cases	Bilateral	Unilateral
Abrams, Edw. T	6	1	5
Anspach, Brooke M	1	1	0
Ashby, Thomas A	1	0	1
Balch, F. G	5	5	0
Barnett, Charles E	1	0	1
Beck, E. G	1	0	1
Belfield, W. T	1	1	0
Benjamin, A. E	8	5	3
Bevan, A. D	5	4	1
Bierhoff, Frederick	1	0	1
Boldt, H. J	3	0	3
Bonifield, C. L	1	0	1
Bonney, C. W	2	2	0
Bovèe, J. Wesley	1	1	0
Brookman, D. C	2	2	0
Bryan, R. C	2	0	2
Buchanan, John J	1	1	0
Bugbee, H. G	2	2	0
Burge, A. J	4	2	2
Cabot, Hugh	5	5	0
Chute, A. L	1	1	0
Cotton, F. J	2	2	0
Cullen, T. S	1	0	1
Cushing, E. W	1	1	0
Davis, Lincoln	1	1	0
Delatour, H. B	5	4	1
Dickinson, Robert L	2	1	1
Dickinson, Gordon K	6	6	0
Eagleson, J. B	1	1	0
Earnest, John G	2	2	0
Eastman, Joseph Rilus	1	1	0
Edgar, James Clifton	1	0	1
Edwards, E. G	1	0	1
Eisendrath, D. N	1	1	0
Elting, Arthur W	4	4	0
Fay, Oliver J	1	0	1
Fairchild, D. S	3	0	3
Fletcher, E. A	1	1	0
Frazier, Charles H	1	0	1
Findley, Palmer	1	1	0
Frick, Wm. J	1	0	1
Fuller, William	2	0	2
Geiger, Jacob	6	3	3
Geraghty, John T	5	5	0
Goggans, J. A	2	0	2
Gordon, Seth C	2	0	2
Griffith, J. D	3	0	3
Grant, H. G	1	0	1
Guiteras, Ramon	2	2	0
Haines, W. D	4	0	4
Hall, R. B	1	1	0
Hamann, Carl A	2	2	0
Harpster, C. M	2	2	0
Harris, D. L	5	5	0
Harris, P. A	2	2	0
Hill, Howard	4	2	2
Hoist, B. C	1	1	0
Jepson, W. M	5	5	0
Johnson, A. B	3	3	0
Jonas, E	1	0	1
Jopson, John H	1	1	0
Jordon, William M	1	0	1
Keller, John G	3	2	1
Keyes, Edward L	2	2	0
King, Alfred	4	4	0
Knott, Van Buren	2	2	0
Krotoszyner, Martin	5	5	0
Law, Arthur A	3	2	1
Lockwood, Charles D	2	1	1
Lord, J. P	1	0	1
Lund, F. B	4	4	0
McKenna, C. M	2	0	2
McVay, John H	2	2	0
Mann, Arthur T	2	2	0
Manton, W. P	1	1	0
Mastin, W. M	3	1	2
Mayo Clinics	22	22	0
Meriwether, F. T	2	1	1
Montgomery, Edward E	1	0	1
Moore, H. A	2	1	1
Moore, J. E	8	7	1
Morris, Robert T	2	1	1

Nicholson, C. M.	3	0	3
O'Crowley, C. R.	2	2	0
Ochsner, A. J.	4	0	4
Peck, Charles	1	1	0
Percy, J. F.	1	1	0
Pilcher, P. M.	2	2	0
Polak, John O.	4	0	4
Porter, Miles F.	2	1	1
Reder, Francis	1	0	1
Robins, C. R.	1	1	0
Schapira, S. William	2	0	2
Schwyer, Arnold	2	1	1
Senn, William N.	3	3	0
Smith, A. Lapthorn	1	0	1
Smith, E. E.	2	0	2
Smith, G. G.	1	1	0
Spitzer, W.	1	0	1
Stone, I. S.	3	1	2
Taussig, Frederick Joseph	1	1	0
Taylor, H. C.	2	0	2
Tenney, Benjamin	2	2	0
Torrance, Gaston	1	0	1
Townsend, William W.	3	2	1
Turck, Raymond C.	1	0	1
Vander Veer, Drs.	10	2	8
Wakefield, F. B.	1	0	1
Warren, J. N.	2	0	2
Ward, G. G.	1	0	1
Walsh Ferdinand	6	5	1
Wells, Brooks H.	3	2	1
Willard, W. P.	4	3	1
Wilson, Nelson W.	1	0	1
Wright, A. L.	3	0	3

In the cases traced the following lengths of time had elapsed following the post-operative recovery, with the patient either still living or dead:

UNILATERAL		BILATERAL	
No. of Cases	Age	No. of Cases	Age
1	25 years	1	11 years
1	18 "	1	6 "
1	12 "	1	5 "
1	10 "	1	4 "
1	9 "	1	3⅔ "
2	8 "	1	3 "
1	7 "	1	1 year 2 months
2	6 "	1	5 months
5	5 "	1	1 month
1	3½ "		
2	2½ "		
4	2 "		
1	1 "		
2	8 months		

The following nine unilateral cases, where nephrectomy was done, are reported by the following men as still living:

Bierhoff, Frederick, 1 case alive after 12 years.

Barnett, Charles E., 1 case alive after 2 years 1 month.

Bryan, Robert C., 2 cases, one alive after 3 years, and one after 8 months.

Geiger, Jacob, 2 cases, one alive after 6 years, and one after 5 years.

Nicholson, C. M., 1 case alive after 8 years.

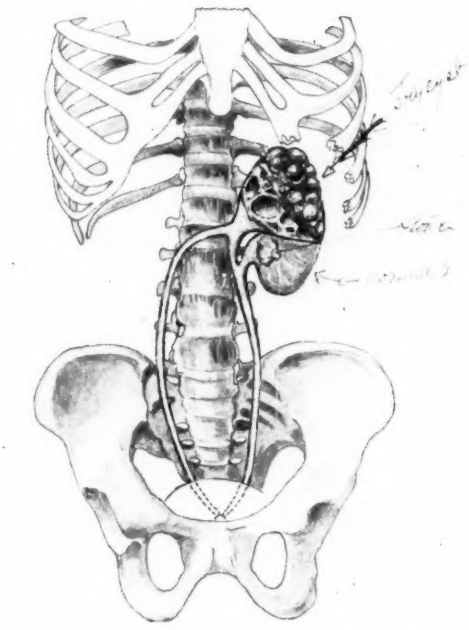

Fig. 1. An anomalous left kidney (no kidney found on the right side) with the right ureter coming from the upper half of the pelvis; the upper pelvis communicating with the lower pelvis and left ureter; a stone present in the pelvis with the upper two-thirds of the kidney polycystic and the lower third normal kidney tissue.

Torrance, Gaston, 1 case alive after 2 years 6 months.

Smith, E. E., 1 case alive after 18 years.

Through the courtesy of Dr. J. N. Vander Veer the writer is privileged to give the following unusually interesting anomalous polycystic kidney case:

Mr. C. B., age 46, bookkeeper. Pain in left side. *Family history.* Father died from apoplexy, aged 60; mother, during parturition, aged 42; paternal uncle, aged 21, died from tuberculosis.

History. Patient had had scarlet fever during childhood, gastritis at 36, and typhoid at 38. About two months ago had stomach trouble with biliary vomiting, after which grippe and pleurisy confined him in bed for ten days. At present complains of nausea, weakness, bronchitis, poor appetite, not rested after sleep. Five weeks ago nose bled for five hours.

Physical examination. Skin pale; red cells, 3,400,000; white cells, 8,500; hæmoglobin, 70 per cent; temperature, 98° F.; pulse, 120; systolic blood pressure, 118; dystolic, 60; heart mildly dilated; no

murmurs; lungs, left-sided mucous râles and signs of pleuritic adhesions.

Cystoscopy. Mild cystitis and trigonitis; ureteral openings normal; catheter up left ureter gives cloudy purulent material; stopped at 6 inches; catheter up right ureter to 9½ inches easily passed; clear urine. Examination indicates left pyelitis. X-ray shows stones in left kidney pelvis with kidney misplaced low down in the pelvis; right side negative. (Unfortunately a leaded catheter was not passed for skiagraph.)

Operation. Kidney delivered; found bipolar; upper half polycystic; in lower half pyelonephritis with stones in pelvis; the bifurcated ureter traced from upper half of kidney pelvis leading down and joining bifurcation of the lower left ureter which drained the lower kidney pelvis; the upper and lower portions of the pelvis non-communicating. Incision was enlarged and hand passed to right kidney, which was found apparently normal. (At autopsy an extra lobe of the liver was found occupying the right kidney fossa.) Left nephrectomy was done. Death occurred one week later from uræmia. Autopsy showed absence of right kidney, with the right ureter crossing over and joining with the upper bifurcation of the left ureter to drain the upper pelvis, which controlled the superior and middle poles of the kidney which was polycystic, while the lower pelvis drained a shell of normal kidney substance whose destruction had been brought about by a self-retained calculus. (See Fig. 1.)

The only way in which this unusual anomaly might have been diagnosed, would have been for one to pass the leaded catheters as a routine, in order to reveal a condition that might not occur again in many lifetimes of work.

In this case the physical findings were not especially bad. While it is of especial interest from its anomalous standpoint, the writer believes it presents some interesting conjectures from a polycystic view. It would seem that the polycystic portion had been acquired rather than congenital; for had the cystic change been present at birth, compensatory enlargement would have been present in the lower segment sufficient to sustain the body. The fact that a single kidney was cystic above and non-cystic below would add another point in disproving the claim that polycystic disease always occurs bilaterally.

CONCLUSIONS

1. The number of bilateral and unilateral polycystic kidneys is overwhelmingly greater than our present textbook statistics would indicate.

2. The question of infection has arisen only in recent years; consequently, future time is necessary in order to show the part of its importance.

3. The known etiological factors are so few that one must necessarily conclude, from the number of hypotheses given, that there are several causes for polycystic kidney disease.

4. Nephrectomy in unilateral cases, where the opposite kidney is proved competent, especially when the tumefied kidney has produced a ptosed viscera, is undoubtedly indicated.

5. From the years elapsing since nephrectomy was done in a number of cases reported, one is led to believe that a unilateral polycystic kidney condition did exist.

NOTE.—Any one reading this article who has had a case not reported in these statistics will confer a favor if he will mail writer a card for blanks to be filled out in order to increase the value of these statistics.

PSEUDOMYXOMA OF THE PERITONEUM

By ELIZABETH G. LEWIS, M. D., San Francisco
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ALTHOUGH cystadenomata of the ovary are not malignant in the sense that they metastasize through the lymph and blood streams, nevertheless they occasionally give rise to secondary growths called "implantation-metastases." The mode of formation of such metastases is scarcely open to doubt. The cyst ruptures either spontaneously or as the result of manipulation during the operation for its removal; a portion of its contents escapes into the abdominal cavity and the movement of the intestines freely disseminates the material. This material contains epithelial elements that may become attached to the peritoneum, undergo proliferation, and reproduce the structure of the original cyst. In case of rupture of a pseudomucinous cyst the implantation of the epithelial elements and the subsequent generation of "daughter cysts" may be confined to a small area or a single organ, as, for example, the appendix; or, on the other hand, the affected area may be extensive involving a large part of the peritoneum. In the latter event the resulting condition is designated pseudomyxoma of the peritoneum.

Other names suggested for this disease of the peritoneum have become obsolete since the nature of the lesion has been better understood. Thus, the designations pseudomyxomatous degeneration of the peritoneum (Mennig) and chronic myxomatous peritonitis (Virchow) were prompted by the erroneous idea that they were dealing with a primary disease of the peritoneum. That this is not the case was first demonstrated by Werth, who clearly established the relationship between myxomatous changes in the peritoneum and pseudomucinous cysts of the ovary. Since the appearance of his monograph in 1884, pseudomyxoma peritonei, the name he suggested for the lesion, has been permanently adopted.

Pseudomyxoma of the peritoneum is not a frequent complication of pseudomucinous cysts. In 1891 Strassmann was able to collect from the literature only thirty-six cases; and in 1908 Schumann added twenty others. Wilson has recently reported six cases which came under his personal observation and computed that about 4 per cent of the cases of pseudomucinous cyst are followed by this complication. Not infrequently a long period of time elapses between the removal of the primary tumor and the development of the peritoneal lesion. And perhaps this is the most remarkable clinical feature of the case following, for 22 years elapsed between the time when the patient was operated upon for the removal of ovarian cysts and the time when she applied for treatment and was found to be suffering from pseudomyxoma of the peritoneum.

M. D., white, widow, age 60. Admitted to the University of California Hospital, October 28, 1912. Complains of swelling of the abdomen with tenderness and pain; chronic constipation; increased frequency of urination; extreme weakness. *Family history.* One sister died of cancer of the breast. Husband died of pulmonary tuberculosis 30 years ago. *Past history.* Diseases of childhood, including scarlet fever. Menstruation began at 17 and occurred regularly every 28 days. Patient has had one child which died in infancy; no miscarriages. When 38 years of age patient was operated upon for an abdominal tumor. Bilateral ovarian cysts were removed which together weighed 19 pounds. After the operation menstruation did not reappear.

Present illness began eight months before admission to the hospital, when patient began to suffer from abdominal pain and subsequently she steadily lost in weight. *Physical examination.* Patient is markedly emaciated. Heart and lungs are negative. Abdomen is very much distended with fluid; and a large, irregular tumor mass is palpable over the whole front of the abdomen. On vaginal examination the mass seems to be connected with the uterus or to the structures immediately to the right of it. *Blood examination.* Red blood corpuscles, 4,600,000. White blood corpuscles, 6,800. Hæmoglobin, 42 per cent. Urine contains a faint trace of albumin but no casts. Specific gravity, 1,008. Wassermann reaction negative. *Exploratory laparotomy.* November 9, 1912, by Dr. W. G. Moore. A large, irregular tumor mass fills out the abdomen and is inoperable; it is attached to the right broad ligament. A great number of small cysts are scattered over the

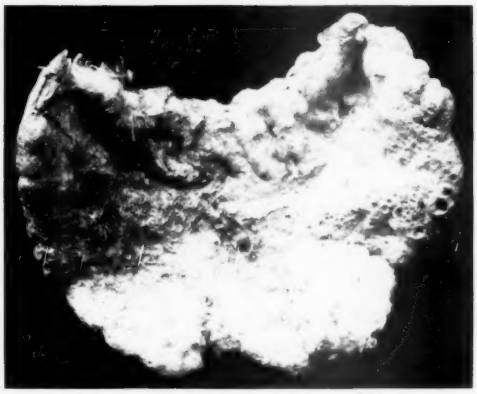

Fig. 1. Pseudomyxoma peritonei, omentum (posterior view).

parietal peritoneum, especially over the ventral portion. About 4 liters of ascitic fluid were withdrawn from the abdominal cavity. In this there were myriads of small free cysts, some clear and others opaque. A number of the cysts measured from one to two cm. in diameter.

Post-operative convalescence was afebrile, and the abdominal incision healed promptly; but the patient progressively lost in weight and strength. February 3, 1913, she died of cachexia. Autopsy eight hours after death by Dr. J. V. Cooke.

Anatomical diagnosis. Pseudomyxoma of the peritoneum and omentum with complete encapsulation of the spleen, liver, and uterus by the tumor. Chronic adhesive pleuritis. Parenchymatous degeneration of heart, liver, and kidneys.

The following is a brief abstract of the pathological findings. The body is that of an emaciated white woman 160 cm. in length. There is a discharge of foul smelling gastric contents from the mouth. The abdomen is considerably distended and there is an old surgical incision above the umbilicus, in the median line. Upon opening the peritoneum there escapes a considerable amount, probably about 1500 ccm., of grayish fluid in which there are grayish flecks and small jelly-like masses. The anterior abdominal wall is adherent to the underlying structures and on freeing it the omentum is found much enlarged and thickened, though its normal shape is preserved (Fig. 1). It measures from 3 to 5 cm. in thickness and is composed of a grayish tissue thickly studded with nodules 1 to 15 mm. in diameter composed of jelly-like substance. In the splenic region there is a tumor mass shaped like a moderately enlarged spleen and measuring 14 x 8 x 6 cm. On section there is discovered in the midst of the mass a small, dark red, rather friable spleen measuring 6 x 5 x 4 cm. (Fig. 2). In some places the jelly-like tumor-nodules, directly continuous with the main encapsulating mass, are seen invading the splenic tissue, but no metastatic growths are seen in the substance of the organ. A portion of the tail of the pancreas is buried in the perisplenic growth.

Also covering the entire surface of the liver is found a thick tumor-capsule varying from one to four cm. in thickness, but no metastases are found in the hepatic tissue (Fig. 3.).

The pelvic peritoneum and viscera show an irregular nodular coating in some places 4 to 5 cm. in thickness. The uterus is small and encapsulated by the tumor. The fallopian tubes and ovaries are not found.

Many tumor foci are found over the surface of the stomach and intestines. Some of these are 5 cm. in diameter and others are smaller, matting together the coils of gut. No lesions are found in the mucosa of the alimentary canal. The kidneys and adrenals show no unusual features. The thoracic viscera present nothing abnormal except some old fibrous pleural adhesions. Brain and cord were not examined.

Microscopic examination. Portions of the tumor growth taken from various places show the same microscopic picture. The tumor consists merely of a mass of cysts held together by a fibrous stroma. The cysts vary considerably in size, from one to fifteen millimeters, and as a rule are circular or oval, although occasionally irregular shapes are seen suggesting pocket-like outgrowths. In places the cyst-cavities are lined by a single layer of cylindrical epithelium, but there is a remarkable tendency to desquamation and many of the cysts show no lining epithelium; when found it is usually limited to a small portion of the cyst. The epithelial cells are usually cylindrical and of the goblet-cell type, but even in the same cyst may be also cuboidal or flattened. The cyst cavities contain a homogeneous material which takes the hæmatoxylin stain. The fibrous stroma, upon which the epithelium lies, varies in amount in different cysts and is rather poor in cells.

Sections of the viscera show nothing worthy of note except a parenchymatous degeneration of the heart, liver, and kidneys.

Bilateral pseudomucinous cysts, such as were removed in this case when the patient was 38 years old, are somewhat more likely to be followed by a recurrence of the growth than unilateral cysts. Pfannenstiel states that extirpation affords complete and permanent relief in 98 per cent of the cases of unilateral cysts, but in only 85 per cent of bilateral cysts. If the cyst should rupture at the time of operation recurrence is favored; but by no means does it occur invariably. On the other hand, local recurrence or the

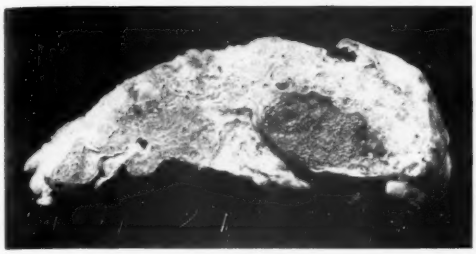

Fig. 2. Pseudomyxoma peritonei, spleen.

Fig. 3. Pseudomyxoma peritonei, liver.

development of pseudomyxoma of the peritoneum occurs in cases when the original tumor has been removed intact and to all appearances completely. Such cases, however, must be explained by the fact that remnants of the tumor were overlooked and left behind.

The variableness of the period elapsing between the removal of pseudomucinous cysts and the development of pseudomyxoma of the peritoneum cannot be satisfactorily explained. Generally an interval of seven or eight years elapses, but occasionally the interval has been as short as five months or as long as 14 years (Tannen), 17 years (Olshausen), and 22 years (author's case). Such long intervals, however, are exceptional; most observers emphasize the rapidity with which the secondary growths develop.

In a measure, variations in the time required for the development of pseudomyxoma of the peritoneum are due to the presence of two opposing pathological processes. Primarily, epithelial elements from the ovarian tumor become implanted upon the peritoneum and reproduce the structure of the original cyst. Secondarily, the peritoneum reacts to the stimulus of the implantations and this reaction constitutes a chronic peritonitis. The proliferation of the peritoneal stroma about the cysts is unfavorable to their growth by interference with this expansion and with the nutrition of the cells which form their lining. Consequently, desquamation and degeneration of the epithelium takes place, and this process actually tends to limit the disease; it probably explains the very rare cases in which the disease is known to have undergone spontaneous cure.

More frequently, on the other hand, it happens that the cysts rupture, their contents are extruded into the peritoneal cavity or into the surrounding tissues, and the implantation cysts are rapidly multiplied. Death is generally due to cachexia which is the result of interference of the normal activity of the stomach and intestines.

Chemical study of the contents of these cysts has attracted a number of investigators, and has led to the identification of a substance which Hammarsten called pseudomucin. This is distinguished from mucin, as Donat first pointed out, by the fact that no precipitate is formed on the addition of acetic acid; nor does boiling cause precipitation. Later Hammarsten demonstrated the presence of a reducing substance in pseudomucin and Zängerle devised a method for isolating the reducing substance (glucosamin). In very few cases, however, has careful examination been recorded. In the case here reported the material for examination was ascitic fluid obtained at operation November 9, 1912, three months before death.

The fluid consisted of about 4,000 ccm. of a slightly turbid reddish brown fluid having a specific gravity of 1,021 and a faintly alkaline reaction to litmus. Floating in the fluid were hundreds of amber-colored gelatinous masses having an average diameter of about 5 mm. The microscopic examination showed granular material, but no cells. On removing the gelatinous masses the ascitic fluid showed the following characteristics: Upon heating, there was formed a thick friable coagulum of albumin. Globulin and albumin

were salted out by half saturation and saturation respectively with ammonium sulphate, heated, washed, dried, and weighed; total nitrogen and uncoagulable nitrogen were determined by the Kjeldahl method. The following results were obtained:

	Gm. per 100 ccm.
Serum globulin	3.638
Serum albumin	3.138
Total nitrogen	0.551
Uncoagulable nitrogen	0.143

A positive test for pseudomucin was obtained by Hammersten's method as follows: Fifty ccm. of the fluid was diluted with an equal volume of distilled water, faintly acidified with acetic acid, boiled, and filtered. This clear filtrate, free from coagulable protein or any mucin that may have been present, was evaporated to small volume, cooled, and five times its volume of absolute alcohol added. The resulting heavy white precipitate was filtered off, washed with absolute alcohol and redissolved in distilled water, there being formed a faintly opalescent fluid. This was tested for pseudomucin by hydrolyzing with an equal volume of 10 per cent HCl on a water bath for two hours until the fluid became a clear brown color. It was then filtered and upon neutralization with 40 per cent NaOH, gave a well-marked reduction of Fehling's solution.

Mucin could not be demonstrated in the fluid. The addition of acetic acid gave a marked cloudiness which could not be filtered off. The precipitate formed on heating with acetic acid showed no reducing substance after hydrolysis with HCl.

The gelatinous masses in the original fluid when heated became thick, opaque, white, and friable. In normal salt solution they swelled, became clear and transparent and did not dissolve in 48 hours. In $\frac{N}{10}$ NaOH they swelled and after several hours dissolved leaving a fibrous material, possibly the cyst capsules. Ten per cent acetic acid caused the masses to shrink and to become opaque and friable. A test for pseudomucin but not for mucin was obtained by treating the gelatinous masses in the manner above described for the ascitic fluid.

Since no case of pseudomyxoma of the peritoneum has been diagnosed prior to operation, it seems well to call attention to the fact that the diagnosis may be made by an examination of the ascitic fluid. In cases of obscure ascites in women, especially when a pelvic tumor is suspected or when there is a history of a previous pelvic operation, the examination of the fluid by the method outlined above would be of great value in arriving at a diagnosis. The test offers no technical difficulties and requires a relatively small amount of time. It must be remarked, however, that difficulty might be encountered in collecting the fluid in some instances from the stoppage of the canula by one of the gelatinous masses.

I wish to thank Dr. J. V. Cooke, under whose direction this work was done.

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ENCHONDROMATA, WITH SPECIAL REFERENCE TO THE SCAPULA

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CARTILAGINOUS tumors in various parts of the body occur with relative frequency and have attracted considerable interest and study. More than one hundred and fifty articles referring to tumors of this type were readily found, most of them being simple case reports. Others, however, dealt with their etiology and pathology, and with the technique of their removal.

In a classification of chondromata, based upon their origin and development, two types are distinguished. The first (the homoplastic group, or ecchondroma) represents a pathological overgrowth of preëxisting normal cartilage; the second (the heteroplastic group, or enchondroma) those which develop where no cartilage is normally found, or, as expressed by Miller, "where there is nothing."

In general, chondromata reproduce the histology of the various types of normal cartilage. Those of the hyaline type are the most common, other forms being seldom found. In these cases the various types of cartilage may occur in different portions of the same tumor, a combination of the fibrous and the hyaline being found most frequently. The histological structure of the superficial portions of these tumors approaches the picture of the normal cartilage most closely, while the variations from the normal arrangement, size, and shape of the cells become more pronounced the deeper the tissue in the tumor (16). The number of cells in contrast to the ground substance is usually increased. Enchondromata may occur also in combination with sarcomatous or cancerous cells.

Chondromata not only reproduce the histology of normal cartilage, but also the general structure, with the complete absence of blood-vessels and nerve fibers in the cartilaginous masses or lobules. Hence, all chondromata tend to undergo degeneration if they grow much beyond the size of the normal cartilaginous structure. This degeneration may be (1) mucous, (2) calcareous, or (3) fatty (fat globules in the cells). Chondromata that contain large stellate (5) cells are usually subject to the greatest mucous degeneration. This degeneration may be so extensive as to cause fluctuation in the tumor. The fluid is of the consistency of the white of an egg and is opalescent, with loose masses of softened tumor floating free in it. However, some enchondromata tend to develop lobules more or less sharply held apart by fibrous tissue; and these do not undergo degeneration so readily (6). When degeneration does occur, it is due to the compression of the blood-vessels by the gradually enlarging lobules. Under such circumstances degeneration is likely to be of the calcareous type. This was markedly true in the case reported at the end of this paper. The fatty degeneration is confined to the cells and is never extensive.

Most chondromata contain chondrin. However, this is not necessarily true. Virchow reports a malignant case in which the tumor yielded no chondrin, although histologically it was composed of typical hyaline cartilage.

Cartilaginous tumors are usually benign and cause no trouble except by their size and position, and come to the surgeon only after they have been in existence a long time. While they are usually tumors of slow growth, a cessation of growth or a retrograde change is rare (6). That they may develop in dangerous localitites and cause serious disturbances, however, is shown by a case reported by Clark and Atwood (1) of a typical multiple enchondromata ranging in size from a pea to a small orange. This case occurred in a seventeen-year-old boy. The patient and his relatives believed that these swellings came and then disappeared spontaneously, undergoing retrograde changes after they had reached a certain size. One swelling finally developed in the sella turcica and caused eye symptoms, paroxysmal headache, and a progressive spastic quadriplegia. However, the eye symptoms improved somewhat, which

Fig. 1. Photograph of the tumor after removal, showing the proximal surface.

led his physicians to hope that this improvement indicated some retrograde changes in the tumor. The patient was kept under observation for two years without any change being noted in the other symptoms. A case of enchondroma of the manubrium sterni causing pressure symptoms is reported by Richardson. This was successfully removed.

Enchondromata may be malignant and destroy tissue just as a true sarcoma. They may also spread to other structures (presumably by buds growing into the veins) and reproduce the same type of encapsulated tumor, but without invading the surrounding tissues. Tumors which grow rapidly are most likely to recur. Cartilaginous tumors of the scapula have been supposed to be especially liable to undergo malignant change, and Johnson (3) states that "The scapula is one of the locations where enchondromata undergo malignant changes." Hertzler suggests that "Cartilaginous tumors about the shoulder should always be regarded with suspicion, for usually they are combined with sarcomatous tissue; and rapidly growing cartilaginous tumors should be regarded as malignant." Walder in 1881 collected twenty-five cases of which number six suffered from recurrences. Buchanan in 1900 collected twenty-five cases and two suffered from recurrences, these two, however, being both included in Walder's tables.

Virchow (4) reports the case of a large cystic tumor twice removed from the scapula. The patient had many recurrences and finally came to autopsy. Walder reports the case of a woman twenty-five years old who developed a tumor of the left scapula which in three months grew to be as large as an infant's head. Histologically, it had the appearance of an ordinary enchondroma. There were six recurrences extending over seven years. She was free from recurrences two years following the last operation, at which time the case was reported. The recurring tumors were cystic and gelatinous. Virchow also reports another malignant case arising from a rib. Following the operation the patient died of a facial erysipelas. The autopsy disclosed a number of tumors of the same type in the lungs and pleura.

In regard to the etiology of cartilaginous tumors, Virchow has shown that in the bones of adults islands of cartilaginous cells that have not ossified are still present; and he has suggested that the occurrence of cartilaginous tumors is in many cases in direct relation to the pathological changes of rachitis and the subsequent process of ossification and growth which would tend to increase the irregularity and number of the cartilaginous elements remaining. These cartilaginous islands, or rests, later develop into tumors if the proper stimulation be given. The tumors of the parotid and testicle are probably always due to embryological rests; and in the case of the parotid, the development of the visceral clefts provides a mechanism which would tend to leave islands of cartilaginous cells.

Trauma has long been accepted as an exciting or stimulating factor in the development of enchondromata. Mosbacher (16) quotes C. O. Weber as stating that in his statistical study of enchondromata a history of injury was obtained in fifty per cent of the cases where satisfactory records had been made. Ziegler and Virchow both emphasize the importance of traumatism by showing that the points where enchondromata usually appear are subject to almost constant irritation; as, for instance, the knee-joint. Shaw reports a

case of a seventeen-year-old girl who had a cartilaginous tumor of the knee-joint which contained a needle in its center. A case is reported by Morton (5) which had fifteen or sixteen tumors of the hand. While they did not interfere with its use, the patient said that the slightest blow would cause another tumor to appear. Sick (9) mentions a case of multiple exostosis and enchondroma, explaining them as a congenital anomaly of growth which separated these cartilaginous islands and gave them a chance to develop. Cottbus (11) reports the case of a man fifty years old who received an injury to the top of his shoulder and later developed a rapidly growing cartilaginous tumor of the head of the humerus, a place which was not directly involved in the injury. Previous to the hurt this man had a small quiescent tumor in the same location, but several months later it started growing rapidly. The history of this case is given in detail; and from it Cottbus reaches the conclusion that the whole bone having been at one time cartilaginous, these islands have remained undeveloped; and each island is a potential enchondroma which may develop into a tumor in the period of growth. He further believes that the impetus to renewed growth of enchondromata often arises from trauma of a trivial character, and that in some instances it may act as the exciting cause in the development of malignant growths on the bases of preëxisting enchondromata which had heretofore shown only benign characteristics. In the case cited Cottbus believes that the growth would never have increased had it not been for the blow, even though the blow did not fall directly upon the part from which the growth originated. He thinks that trauma plays this stimulating rôle only when the conditions are such as he has described; and the secondary influence of trauma in the appearance of these growths explains more satisfactorily the simultaneous appearance of enchondromata in various parts of the body, or their development in the depths of the pelvis or skull. However, practically all who have studied this question agree that there is a close relationship between trauma and other irritants and the development of enchondromata.

Fig. 2. Microphotograph of section of tumor near the surface.

This belief, based upon clinical observation, is further confirmed by Helmholtz (10), who in 1907 produced multiple chondromata experimentally by the injection of a solution of Sudan III and olive oil in the ear of a rabbit. After this mixture was injected, the stellate connective-tissue cells multiplied very rapidly and then developed into nodules of typical hyaline cartilage. It was found impossible to predict which of these embryonic cells would develop into ordinary connective tissue and which into cartilage. He was also able to show definitely that these were not buds or offshoots from the normal cartilage of the ear, but definite tumors developing in the new connective tissue arising on account of the stimulation caused by the Sudan III.

In regard to the relationship between the development of enchondromata and heredity there seems to be but little evidence. The two instances in which heredity may have had a bearing are: one case, reported by Marchand, who observed four or five cases in one family; and another reported by Weber, where the grandfather, father, and daughter suffered from enchondromata and exostoses. However, rachitis might also account for their occurrence.

Enchondromata of the bone occur most frequently in the young or in young adults. Virchow (14), in the analysis of ninety-four cases involving bone, reports that one-half developed before the second decade and almost one-third occurred in the first decade. The bones of the hand were most frequently involved during the first decade and other bones during the second and third decades. The order of frequency in which the various bones are involved is as follows:

1. The bones of the hand.
2. The hollow bones — tibia and femur in a similar ratio; fibula seldom.
3. The jaw, pelvic bones, and scapula.
4. The ribs, the skull bones (especially the occipital bone).
5. The vertebræ, sphenoid, and sternum, these being the least prone to develop them.

The growth of these tumors is almost entirely at the periphery either of the whole tumor, or if lobular, then at the peripheries of the lobules. Both the time of appearance and the method of their growth support the belief that there is a close connection between the ossification and growth of bone and the development of the tumors.

Enchondromata involving soft parts — such as lymph gland, parotid, or testicle — occur later in life. Those depending upon the presence of cartilage, such as develop in the knee-joints, may occur at any time, and are particularly likely to be caused by injury, arthritis deformans, or allied conditions.

Sarcoma of bones also occurs largely during youth and early life. The involvement of scapula by sarcoma has been discussed by Rawling (7), who reports a case occurring in a child four years old. He collected twenty-three recorded cases of bone sarcomata occurring in children. Four of these involved the scapula, and none of them was saved by operation. These cases are all typical sarcomata, none of them being malignant enchondromata.

Surgical removal of these tumors is the only method of treatment, and in the case of the involvement of the scapula it resolves itself into the question of the dangers of a complete or partial excision. The first recorded case of complete avulsion of the arm and scapula, with recovery, is mentioned by Buchanan (13). On August 15, 1773, a miller in this condition was brought to St. Thomas Hospital (London). His condition was due to an accident, and he finally recovered from it. According to Simon (15), the operation for total extirpation of the scapula for a malignant growth was first performed in 1835 by Dixy Crosby. The patient died four years later from recurrences. In one hundred and twenty-two cases collected by Simon seventeen died as a direct result of the operation. In an analysis of one hundred and twenty-four operations of total extirpation of the scapula since the antispetic era, Buchanan found a mortality of ten and one-half per cent. In one hundred and eighty-one cases, including those before the antiseptic era, the mortality was sixteen per cent. In four cases, where total excision was performed for enchondromata, one died from the operation and one died after eighteen months from a recurrence in the lung (v. Langenbeck's case). In twenty-one cases where a partial excision had been performed for enchondroma of the scapula, six died as a result of the operation; of the fifteen survivors there were no histories of recurrences, though the amount of time when the cases were observed was not sufficient to preclude the possibility of malignancy. Those operated upon since the development of modern technique showed a mortality of nine per cent. Now that safer methods of operation are practised, the mortality would undoubtedly be less. Miningham (2) reports a case of enchondromata occurring on the right scapula of a young man twenty-five years old. It had existed for twenty years. There was no history of traumatism. Upon excision the enchondroma weighed seventeen pounds. At the time of operation a portion of the scapula, with the glenoid cavity, was left. The patient was well eight months after the operation.

The following is the author's case:

History. Patient aged 30; male; white; admitted to the hospital on June 5, 1908. He had always been robust. Seven years ago, while at work in the hay field, he was injured in the right axilla by a sharp blow from the handle of the fork that he was using. The joint continued sore the remainder of the summer. The following fall he

noticed a small lump in the axilla. This lump was hard, of slow growth, and gave him no pain. Two years previous to his admission to the hospital it began to grow rapidly and the original mass was pushed forward under the pectoralis major. At the time the patient presented himself for treatment the tumor had become so heavy that he was unable to hold himself erect and leaned toward the left, his spine showing considerable curvature. His arm was freely movable, except in a downward position where the tumor interfered, although it had never caused any pressure or pain in his arm.

The examination showed the patient to be a well-nourished young man. The heart and lungs were normal; the hemoglobin was one hundred per cent; the urine negative. His right scapula was the seat of a tumor that was hard and elastic, with many prominences. Toward the angle of the scapula there was fluctuation (from degeneration). Large veins showed over the entire surface of the tumor, but the skin was in good condition. The scapula was freely movable over the thorax. The arm was strong and free. The vertebral border and the scapula above the spine seemed uninvolved.

Under cocaine a small piece of the tumor was removed and frozen sections were made. It showed pure hyaline cartilage with a deposit of calcium salts. At the points where the blood-vessels entered the tumor these were large in amount. The upper portion showed marked mucous degeneration. A test for the presence of chondrin (kindly made by Mr. Watson) showed its presence in very small amounts. It measured fourteen inches long by thirteen and one-half inches wide, weighing after removal fourteen and one-quarter pounds.

The topography of the tumor and its relation to the surrounding structures were carefully studied before the operation. The tumor was removed by dissecting it free and dividing the scapula just above the spine. It was not necessary to open the capsule of the joint; and the entire glenoid cavity was saved. The muscles removed were the latissimus dorsi, the teres major and minor, the infraspinatous, and the greater part of the subscapularis. The trapezus and its nerve and the circumflex were divided. The serratus anterior was not disturbed. The patient left the hospital on the sixteenth day after the operation.

It has been six years since this tumor was removed, and so far there has been no evidence of recurrence. The patient has good use of his arm, though in order to put it above his head it is necessary to give it a swinging movement, due to the loss of the use of the deltoid.

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MALIGNANT PAPILLARY CYSTADENOMA OF THE KIDNEY WITH METASTASES[1]

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In a review of the literature on tumors of the kidney, one is impressed with the multiplicity of terms used in the diagnosis of these new-growths. This applies more particularly to tumors of the renal pelvis, so that apparently the same or closely allied tumors are described under various names. The case which is here reported we have designated a malignant papillary cystadenoma, because it has the following characteristics: it was of extensive growth, with metastases resulting in death, and consisted of villous processes within cystlike spaces. Our reasons for reporting this case are its interesting clinical and unusual pathological features.

The patient, W. H., male, aged 17, was first seen by one of us November 13, 1912. At the age of 9, he was sick for several months with typhoid fever. Two months after he recovered from the fever, his physician noticed that the boy's urine was bloody. At this time he was in the hospital, receiving cold baths, etc. One and one-half years ago (at the age of 15½) the patient discovered that his urine was bloody. He was put under hospital treatment for a few weeks and the hæmaturia decreased. This apparent improvement lasted for about a week, after which time the urine appeared just as bloody as before. A cystoscopic examination was made at this time, but the origin of the blood was not determined.

Early in the onset of his trouble the patient had had difficulty in passing urine, due to the presence of large blood-clots. At the present time the hæmaturia is intermittent. The urine is more often clear than bloody. There are no urinary symptoms. Seven and one-half weeks ago, while lifting a heavy barrel of vinegar, the patient strained his back. This was followed by a very profuse hæmaturia and severe attacks of renal colic. Pain was present on both sides of the back, and the attacks become so severe that the patient was operated on during the night for a supposed attack of appendicitis. The appendix was found normal and was not removed. At the time of examination, the patient complained of a pain in the loin which did not radiate but was aching in character.

Physical examination (by Dr. James B. Herrick). The patient was pale and anæmic. The subcutaneous fat was well developed. There was a well-defined pad of fat over the pubes.

Head: The pupils were equal and reacted to light and accommodation. Extra-ocular movements were well performed in all directions. The left infraclavicular and supraclavicular fossæ were filled even with the clavicle with a soft non-fluctuating tumor which had no definite margin. It was not attached to the skin and was not lobulated, being slightly tender and of the consistency of soft fat. The superficial glands were palpable, but not hard.

Chest: The chest was well-formed and symmetrical. Lungs: There was free expansion as shown by Litten's sign. There were no râles.

Heart: The heart was negative; blood-pressure, 125.

Abdomen: A large, palpable mass was found deep in the right flank. The liver and spleen were not palpable. There was free fluid in the abdominal cavity.

Blood: December 16, 1912: Red cells, 3,900,000; white cells, 6,500; hæmoglobin, 58 per cent.

Urine: Red color, 1.022; neutral reaction. Albumin, positive. No casts. No tubercle bacilli were found in the urine. Microscopically, many red blood-cells and a few leucocytes.

Tuberculin test gave a reaction of 99.6. Local reaction was negative.

Wassermann reaction, January 3, 1913, was negative.

Cystoscopy: November 13, 1912. Bladder mucosa pale. No stone or tumor found. Ureteral orifices normal. Double-sided ureteral catheterization: no blood or urine from either catheter during a period of observation of nearly two and one-half hours.

X-ray examination by Dr. Potter: This showed the outline of both kidneys. On the upper pole of the right kidney is a round trabeculated structure about the size of a peach. It was thought that it might be possible to inject the pelvis of the right kidney with cargentos and then take an X-ray picture to determine whether or not there was a connection between the pelvis of the kidney and this apparently bony shadow (Fig. 1). The attempt failed, as was determined later, because there was no connection between this bony formation and the kidney pelvis.

The patient died May 3, 1913, at 6 A. M. An autopsy was held at 10 A. M. the same day.

Anatomical diagnosis. Extensive tumor of the right kidney with metastases into the retroperitoneal,

[1] Read at the meeting of the American Urological Association, Philadelphia, June 18, 19, and 20, 1914.

juxta-aortic, and mesenteric lymph-nodes, the liver, stomach and diaphragm; marked chylous ascites; erosion of the lumbar vertebræ; œdema of the left leg; cloudy swelling and disseminated fatty changes of the liver and left kidney; hyperplasia and passive hyperæmia of the spleen; healed operative scar in the abdominal wall.

The body is that of an emaciated young man, 17 years of age and 172 cm. in length. The abdomen is markedly distended, tense, and fluctuates on palpation. There is a healed vertical scar in the abdomen near the midline below the umbilicus.

On opening the thin abdominal wall there escaped approximately 16 to 20 liters of a milky, blood-stained fluid. The under surface of the diaphragm is covered with innumerable nodular soft new-growths, varying in size from that of a split pea to a hazelnut. They are soft, of a grayish white color, and cut easily, leaving a surface granular in appearance. There are numerous similar nodules, varying in size from 2 to 8 cm. in diameter, on the under surface of the liver, especially marked in the left lobe. Scattered nodules of like appearance are also present in the serous coat of the lesser curvature of the stomach, in the mesentery of both the small bowel and the sigmoid, and in the glands about the head of the pancreas. The linings of the superior mesenteric, splenic, and portal veins are smooth.

The left kidney is of normal size. Its veins passed anterior to the aorta. Its capsule stripped easily, leaving a smooth surface, and there are no alterations other than those recorded in the anatomical diagnosis.

The right kidney measures 19 x 10 x 15 cm., weighs 2,875 gms., and is firmly adherent by fibrous connective tissue to the under surface of the right lobe of the liver and also to a mass of irregularly enlarged retroperitoneal lymph-nodes. The surface, especially the upper three-fourths, is nodular. There are three distinct bulging masses, the largest of which is the size of a fist and the smallest that of a goose-egg. The greatly thickened capsule contains many tortuous engorged blood-vessels. The upper part of the tumor is of bony hardness in some places, and in others it crackled on pressure. On section (Fig. 2), only the lower one-fourth of the mass is found to be kidney and this is separated from the tumor by narrow bands of dense fibrous connective tissue. The cortex and medulla are hypertrophied. The usual relation between the two is unaltered. A few small isolated grayish granular foci of tumor tissue, varying in size from 1 to 3 mm. in diameter, were found in this part of the kidney. Their histologic characteristics will be taken up later.

The tumor proper, which comprised the upper three-fourths of the mass, is irregularly separated into varying sized lobules by connective-tissue trabeculæ. In the upper part of the tumor, these trabeculæ are so infiltrated with calcium that it is necessary to use a saw in order to section it. Scattered here and there between the calcified trabeculæ are irregular masses of necrotic and soft friable tumor-tissue. There are also scattered regions of hæmorrhage throughout the tumor, thus giving it many colors. The necrotic areas are grayish white, and the tumor tissue proper varies from a grayish yellow to a pale reddish brown, with here and there scattered dark reddish regions of hæmorrhage. The reddish brown areas have a finely striated appearance and can be shelled out completely, leaving a smooth glistening wall to the remaining cavity. *The kidney pelvis, although greatly distorted, is free from tumor tissue.*

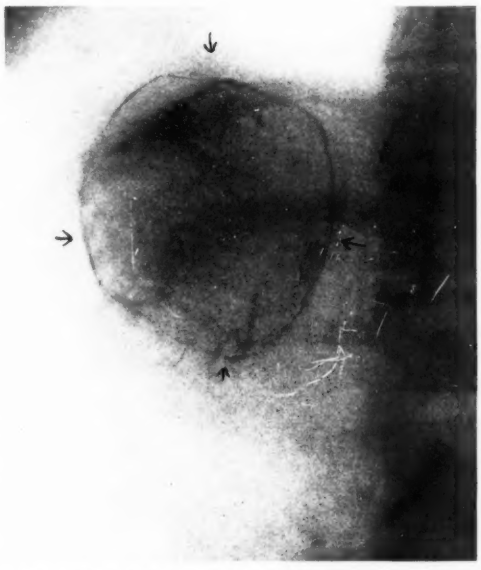

Fig. 1. Radiograph showing calcification in the tumor.

Secondary tumors (Fig. 3), involving the retroperitoneal lymph-glands, are so extensive that they form one large mass, which is located anterior to the spinal column and extends from a point on the level with the cœliac axis to the level of the urinary trigone below. It is 30 cm. in length, 11 cm. in breadth, and 4 to 8 cm. in thickness. It is so firmly adherent to the vertebral column that parts of the bodies of the vertebræ, which are eroded, have to be removed with the tumor. The aorta and the iliacs are included and surrounded completely by this mass, whereas the vena cava inferior, from a point 3 cm. above its origin, passes between it and the kidney, being greatly narrowed as it does so. Inasmuch as permission to open the thorax could not be obtained, the diaphragm was opened and the heart and lungs were examined by palpation. No abnormal findings were demonstrated in this limited manner.

Histological findings. Pieces of tissue removed from various parts of the primary and secondary growths, as well as the metastases in the kidney

Fig. 2. A, area of calcification; B, connective-tissue septa; C, metastatic nodules in parenchyma.

(Fig. 7), were of similar appearance and structure, microscopically. There were branching and interlacing villous or papillary processes extending into and in many places completely filling cystlike spaces. These processes had definite fine connective-tissue stalks, in which were many small capillaries. They contained from one to six or more layers of low columnar and narrow cylindrical epithelial cells. The cells covering the villi were continuous with the lining of the cyst-walls, which were of a flat cuboidal type (Fig. 4). There were regions where the cells were closely massed together with only very small amounts of connective tissue or blood-vessels, so that the villous characteristics were lost (Fig. 5). Here and there, scattered throughout some of the sections, particularly in the metastatic tumors of the lymph-nodes, were cells with mitotic figures.

Fig. 3. Showing the extensive involvement of the retroperitoneal lymph-glands.

There were also scattered deposits of blood-pigment, regions of more recent hæmorrhage and all stages of degenerative changes, even to calcification (Fig. 6). Even in the metastatic nodules were many small scattered foci of deposited lime salts. Some of the small cysts were filled with desquamated cells and lime salts. Frozen sections stained with Soudan III showed the presence of fat in varying amounts, irregularly distributed throughout the tumor.

Reported by	Place	Age	Sex	Hæmaturia	Colic	Metastases	Nephrectomy	Result	Autopsy	Remarks
J. Israel	Klinik der Nierenkrankh., p. 516	42	M.	Profuse	Yes	Femur and humerus	Yes	Recurrence		
J. Israel	Klinik der Nierenkrankh., p. 516	49	F.	Profuse	Yes	None	Yes	Cured		
J. Israel	Klinik der Nierenkrankh., p. 517	55	M.	Turbid urine	Yes	None	Yes	Cured		
J. Israel	Klinik der Nierenkrankh., p. 518	52	M.	Present	Yes	Right renal vein; vena cava inferior	Yes	Sudden death on table		
Garceau	Tumors of kidney, p. 134	56	M.	Never	No	None			Yes	*
Eisenstaedt	Surg., Gynec. & Obst., iv, 353	56	M.	Frequent	Yes	Liver, lung, diaphragm, Lymph glands, muscles, R. veins	Yes	Died	Yes	
Squier	Ann. Surg., Phila., liv, 585	43	M.	Yes	Yes	None	Yes	Cured		
Shoemaker	J. Am. M. Ass., Oct. 15, 1910	27	F.	Yes	Yes	None	Yes	Cured		
Grohe	Deutsche Ztschr f. Chir., lx, 1	58	F.	Not noticed		Retroperitoneal lymph-nodes			Yes	*
Sudeck	Virchow's Arch., cxxxiii	66	M.			Adrenal, lung, lymph-nodes, heart-muscle			Yes	*
Kretschmer and Moody	Surg., Gynec. & Obst., this issue	17	M.	Yes	Yes	Liver, stomach, diaphragm, abdominal and lymphatic glands	No	Died	Yes	

* Discovered at autopsy.

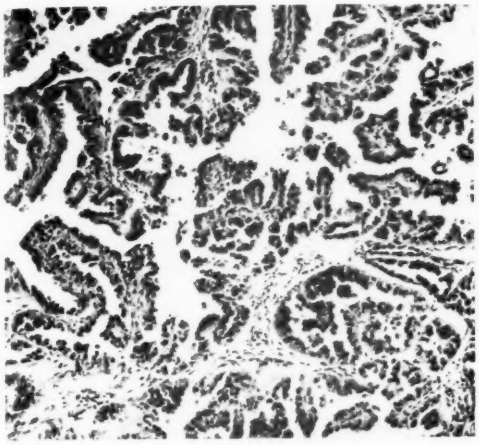

Fig. 4. Showing cells covering villi. They are continuous with lining of cyst-wall and are of a flat, cuboidal type.

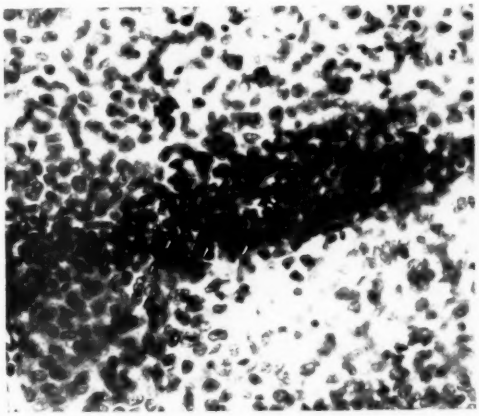

Fig. 5. Showing cells massed together, with small amounts of connective tissue or blood-vessels. The villous characteristics are lost.

In a review of the literature we have found reports of some 75 cases of papillary tumors of the kidney arising from the pelvis. Although the tumor in our case resembles in some respects those of the pelvis and ureter, we feel that any pelvic connection in this case is excluded, because the pelvis was free from any tumor growth. Therefore, our discussion must be confined to tumors arising within the kidney substance proper.

We have so far been able to find reported only ten cases which resemble the main characteristics of the tumor under discussion. These are, briefly, tumors arising from regions within the kidney parenchyma, having cystlike spaces into which project villous processes and which produce metastases of a similar character. In only one case, that reported by Eisenstaedt, were the metastases as extensive as in our case. All but one of the reported cases occurred in individuals over 40 years of age. Our patient was 17 years old.

Three of these cases were found at autopsy; namely, those of Garceau, Grohe, and Sudeck. The remaining seven cases were clinical, presenting symptoms from which the patient sought relief. Hæmaturia was the predominating symptom in seven cases. In Israel's third case the history of hæmaturia is indefinite, the patient complaining of a swelling or a tumor in the side.

As regards sex, there were three females and eight males. The youngest patient was our case, aged 17; the oldest was that of Sudeck, aged 66. Between these figures, there was one aged 27, one 42, one 43, one 49, one 52, one 55, and one 58. All of the clinical cases had renal colic undoubtedly due to the passage of blood-clots.

Another unusual feature is the enormous amount of lime salts present in the metastatic, as well as in the primary, tumor. The cases reported in the literature contained none or only small amounts of such deposits.

This tumor, the malignant papillary cystadenoma, is to be differentiated from the Grawitz tumor and the so-called Wilms tumor. In the Grawitz tumor of the adenopapillary type the cells are large and vacuolated, and they form columns rather than cysts. The Grawitz tumors have a great tendency to invade the renal vein, whereas in our case the veins were unaltered. This case differs from a Wilms tumor in that it did not contain bone, muscle, or cartilage, although in the gross and especially from the X-ray plates, a Wilms tumor was suspected.

Metastases. Metastases were present in all of the cases coming to autopsy (except

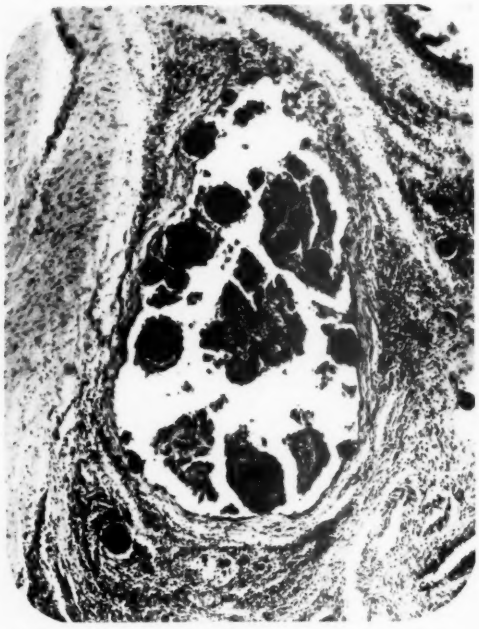

Fig. 6. Showing areas of calcification in the metastases.

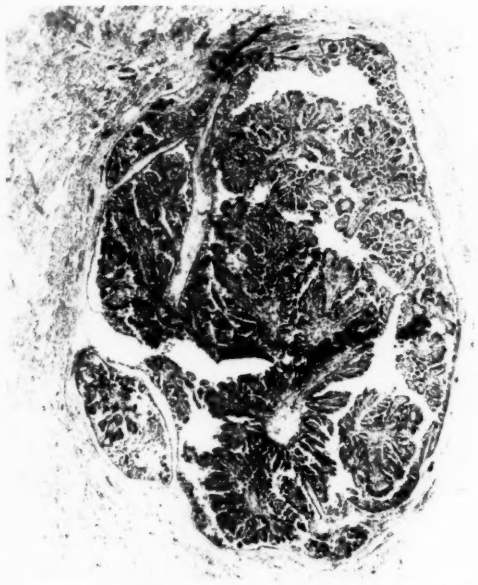

Fig. 7. Histological section of metastatic nodule in kidney parenchyma marked (C) in Fig. 2.

Garceau?). No metastases were recorded in two of Israel's cases and in the case of Squier and Shoemaker. The time elapsing between the operation and the time of reporting the cases, perhaps, has been too short, and subsequent reports of these may show metastases later on.

Regarding exciting factors in the production of the hæmaturia, the following were mentioned:

Fall on the ice (Israel).

Followed heavy marching (Israel).

After vomiting and sea sickness (Israel).

Strain after heavy lifting (Moody and Kretschmer).

Diagnosis. The clinical diagnosis must always remain that of renal neoplasm, which was comparatively easy in this case when the patient first came under our observation. Of greater difficulty was the determination of the type of new-growth under consideration. This was somewhat obscured by the X-ray findings, which showed the presence of a round, trabeculated structure in the region of the kidney. Fluoroscopy demonstrated that the shadow-producing body was below the diaphragm.

The enormous size of the tumor, the age of the patient, and the presence of this apparent bony shadow led us to believe that we were dealing with a mixed tumor of Wilms. The persistent profuse hæmaturia, however, was not consistent with this diagnosis, for, as a rule, these mixed tumors do not produce hæmaturia.

For the purpose of further elucidation regarding the origin and possible nature of this apparent bony shadow, pyelography was carried out. This failed to demonstrate the presence of fluid within the bony shadow, because of the absence of any connection between it and the pelvis.

Origin of tumor. From the description of the gross specimen it is self-evident that this tumor had its origin in the upper half of the kidney. Because of the presence of extensive calcification and degeneration in the upper part of the tumor, we believe it to be the oldest part, and therefore it had its origin in the region of the upper pole of the kidney.

Pathogenesis. Various explanations have

been put forth from time to time to determine the origin of various epithelial tumors of the kidney. According to Dunn, aberrant epithelial structures fall into three groups, namely:

1. Rests of suprarenal tissue.
2. Adenopapillary tissue.
3. Papilliferous cysts.

He believes that the latter two take their origin from the kidney tubules, basing his conclusions on the fact that he was able to demonstrate with microscopic sections a communication between the cysts and the convoluted tubules. These changes were found in kidneys showing chronic inflammatory changes and in individuals averaging 55 years of age. Of general clinical interest is the statement in the history that the patient had a profuse hæmaturia with his attack of typhoid fever at the age of 9. The origin of this hæmaturia might have been due to a toxic nephritis associated with his typhoid, or it might have been due to the typhoid bacilluria.

This brings up the question of whether or not the neoplasm was present at that time and suggests that possibly the hæmaturia at this time was due to its presence. This fact cannot be definitely determined, but it is reasonable to assume that the tumor did not cause the hæmaturia at the time of his typhoid. Of significance in this connection is the long interval between the first hæmaturia and the onset of his last illness (6 years) and the duration of his last complaint (1½ years), during which time there was a very rapid growth of the tumor, as well as its metastases.

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A STUDY OF THE EFFICIENCY OF THE SEELIG–GOULD METHOD OF TESTING ANTISEPTIC SOLUTIONS[1]

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UNTIL the publication of a recent paper by Seelig and Gould (1), no satisfactory method appeared to have been devised to test the efficiency of antiseptic solutions under conditions which at all approached those used in ordinary surgical procedures. That the various methods hitherto employed all are open to some criticism will be pointed out in a brief review of the more important literature. Their suggestion of employing living animal membranes seemed so promising from the results given in their paper that, even though the conditions of the experiment were much more rigorous than would be actually demanded of an antiseptic under clinical conditions, it was deemed advisable to repeat and extend their observations by testing most of the common antiseptics employed in surgery. Accordingly, the following research was undertaken.

Before discussing the method and its application in detail, however, it may be well to review briefly the various means that have been employed previously. Of the numerous suggestions, the following may be selected as being the most important and typical.

Koch (2), in 1881, used what has been termed the "thread method." He immersed a thread in a bouillon culture of the organisms to be tested, and, after allowing sufficient time for its thorough impregnation, removed the thread and dried it. Next it was suspended in a germicidal solution and the length of time taken to kill the organisms determined by making plants on agar from the thread. This technique was open to criticism on two grounds: *first*, that the vitality of the organisms might be diminished by the desiccation; and *second*, that a certain amount of the antiseptic would infiltrate the thread and continue to act for a longer time than his data would indicate.

Two years later, Miguel (3) announced that he would "treat the subject in a more general manner by making known simply the minimum weight of the substances capable of preventing the evolution of any bacteria or germs." To accomplish this he added to a standard culture media a known weight of the antiseptic and a mixed culture of organisms obtained from the dust of a dwelling house or hospital, or from sewage. Obviously, Miguel's treatment of the problem is at fault in not recognizing the particular kind of bacteria with which he deals, their individual resistance to germicides, or the possible results of symbiosis.

In 1879, Paul and Krönig (4), two physical chemists, discussed the subject in strict accordance with physicochemical principles, emphasizing three factors which must be kept constant; i. e., the number and species of the organisms, the temperature, and the media (which must be free from organic material). They took chemically clean garnets and coated them with an agar emulsion of bacillus anthracis or staphylococcus. These were then dried twelve hours at 7° C. Next the coated garnets were placed in platinum sieves and hung in germicidal solutions at 18° C. for varying periods of time. The reaction was stopped by washing in water and chemically neutralizing the germicide, and the garnets were again washed by shaking in water. They were heated to 37.5° C. and mixed with agar, from which plates were poured. They concluded —

1. That the number of colonies obtained was dependent upon the time of reaction and the molecular concentration of the antiseptic solution.

2. That the germicidal action of acid solutions is parallel to the degree of dissociation; i. e., the number of free H-ions in the unit volume of solution. The anions and undissociated molecules have germicidal action, but this is insignificant.

3. That the action of a base is parallel to the free OH-ions in unit volume of solution.

Sternberg (5), a United States Army sur-

[1] This paper is an abstract of a thesis presented for the degree of Doctor of Medicine, Yale University.

geon, devised a method whereby he introduced into a small flask, the end of which had been drawn to a fine capillary tube, definite amounts of culture media and antiseptic solutions. The end of the tube was then sealed by heat and the flask sterilized by prolonged boiling. The seal was broken, the organisms introduced from other similar flasks, and the innoculated flasks incubated for growth. Rideal and Walker (6), in 1903, used the "drop method," which was merely a modification of Sternberg's plan. They added a small but definite amount of standard cultures of standard age to equal volumes of various antiseptics and then plated from these dilutions.

Post and Nicoll (7) modified the last method, using the following technique: One-half cubic centimeter of the solution to be tested was placed in a small test tube and to this was added a platinum loopful of bouillon emulsion of a 24-hour blood-agar growth of organisms. At intervals of one, ten, and thirty minutes, and twenty-four hours, a loop of contaminated test solution was thoroughly mixed in a tube of blood-agar, and plated. After twenty-four hours' incubation the number of colonies was counted and tabulated.

None of the methods hitherto described, of which the above are fairly typical, is applicable in estimating the efficiency of an antiseptic in the surgical problems of skin disinfection preparatory to operation, or their use in infected wounds, abscess cavities, etc. The methods are of undoubted value in determining that a drug *has* antiseptic value, and, to a certain extent, in determining the relative antiseptic power of various drugs and chemicals. But, even though a certain reaction takes place *in vitro* under ideal conditions, we have no right to assume that similar reactions occur when dealing with dead or living animal membranes. Unfortunately, in the practical application of antiseptics, organisms must be treated as they lie buried in the deeper layers of the skin or surrounded by necrotic cells or body secretion, more or less protected from the action of the antiseptic.

Accordingly, when Seelig and Gould (1) published the results of a series of experiments under the title, "Osmosis, an Important Factor in the Action of Bacteria," confining themselves chiefly to the problem of skin disinfection, and arguing that to reach the bacteria a germicide must penetrate the deeper layers of the skin, their results seemed to indicate that at last a method had been devised which would satisfy the conditions to be met in the practical application of germicides. Maillard (8) had already stated that "all experiments thus far err in that osmosis is ignored"; and Eckhardt is quoted as stating that the diffusion velocity of an antiseptic is directly parallel to its germicidal effects. Based upon these and other observations, Seelig and Gould devised a technique which approaches the conditions met in practice, for it takes into account osmosis, a factor hitherto disregarded in testing the relative germicidal power of different antiseptics.

Their views were tested in two series of experiments, one using celloidin capsules for the semipermiable membrane, and the other by the employment of dead and living animal membranes. Their capsules were made according to a modification of the Harris method. Half a gelatin capsule is fitted over the end of a glass tube and sealed to the tube. This is dipped in celloidin, which is allowed to harden; then the gelatin is dissolved in hot water, leaving a celloidin bag fixed to the end of a glass tube. Bouillon cultures of various organisms were placed inside the capsules and the whole suspended in the antiseptic solution. Loopfuls of bouillon were removed from the capsules, at intervals of from ten minutes to twenty-four hours, and plated on agar.

Where living animal membranes were used the conditions were much more severe than those encountered in the operating room; but the results reported were encouraging, and it seemed that by applying such a rigorous test any conclusions regarding the efficiency of an antiseptic would certainly be true. They dissected off a large skin flap from the shaved abdomen of a rabbit, and, having turned it back, fur side down, pouched it into a small vessel by means of a glass depressing rod. Into the upper, or visceral, layer of the flap thus pouched they poured pure bouillon cul-

ture of the organism to be tested, and in the vessel below placed a solution of antiseptic. Loopfuls were withdrawn from the culture in the pouch at varying intervals and planted on agar. Their results indicated that osmosis took place between the two fluids, for, after periods of time varying with the antiseptic and the membrane employed, the agar plants no longer showed growth, and in certain instances chemical tests were made to demonstrate the presence of the antiseptic inside the pouch.

In brief, their conclusions were as follows:

1. With celloidin capsules, iodine (12.5 per cent in water and KI), alone of all the solutions tried, would penetrate the contained bouillon culture in twenty-five minutes and prevent the growth of organisms. The actual presence of iodine was shown by the starch test.

2. With celloidin capsules, alcohol in the higher strengths penetrated with remarkable rapidity, no perceptible increase in antiseptic efficiency being observed above 95 per cent, but below 95 per cent alcohol is effective in proportion to the percentage strength.

3. With the exception of iodine, substances dissolved in alcohol showed no increase in efficiency over alcohol alone where celloidin capsules were used.

4. Tincture of iodine penetrated the celloidin and killed even more rapidly than strong alcohol.

5. The above conclusions were all verified on animal membranes.

6. Bichloride of mercury, 1:5,000, was ineffectual with all membranes; while a dilution of 1:1,000 penetrated and killed in forty-five minutes.

7. Phenol, five per cent, effectually penetrated animal membranes in three minutes, though it failed with celloidin.

Since Seelig and Gould were able to report such definite results with their technique, it seemed desirable to repeat and extend their experiments. However, this technique was somewhat modified by me after a few attempts.

Although the problem of osmosis properly lies in the field of physical chemistry, nevertheless the problems to be solved in this particular instance are of clinical rather than of pure scientific interest. Consequently, it is perhaps justifiable to use the method as described by its authors, under conditions which do not fulfill all of the requirements of a rigidly conducted physicochemical experiment.

The following series of experiments were performed in the surgical laboratory of Yale University, and all cultures were obtained from the stock of the bacteriological laboratory. All experiments were made with twenty-four-hour cultures unless otherwise noted.

TECHNIQUE

In the first series, celloidin capsules were employed. These were made as follows: An eight per cent solution of celloidin in equal parts of absolute alcohol and ether was poured into a large clean test tube and then allowed to drain until a thin, even layer remained on the inside of the tube. The latter was filled with cold water and allowed to stand a few minutes until the celloidin was thoroughly hardened. With a sharp knife the excess was pared away from the top of the tube, and then the capsule was gently dissected off by allowing a bubble of air to come between the glass and the membrane. The capsules were stored in water to prevent drying and cracking, and as needed their open ends were sealed to glass tubes with celloidin.

A series of these tubes fitted with celloidin bags was suspended in a rack and in each tube was placed 2 ccm. of a saline suspension of agar growth of organisms. These were allowed to stand for at least ten minutes to be certain that there were no pin-point leaks as indicated by drops collecting at the bottom of the capsule. In the meantime small staining-dishes were filled with various antiseptic solutions. Then the rack was picked up and the capsules lowered simultaneously into the solutions.

At intervals, loopfuls of the contained cultures were withdrawn and planted on agar slants which were incubated and observed after twenty-four hours. In preparing these bacterial emulsions, the growth from two 24-hour agar cultures were washed into 30 ccm. of normal saline and then vigorously shaken to break up any clumps of organisms. In all of this series bacillus pyocyaneus was used, as the pigmentation offered a ready and rapid means of detecting growth.

DATA OBTAINED BY THE CELLOIDIN CAPSULE METHOD EMPLOYING VARIOUS ANTISEPTICS IN CONCENTRATIONS ORDINARILY USED IN SURGERY

The antiseptics selected are those in common use. As far as possible the conditions have been kept constant in all the experiments. The control solutions were taken from the same stock solution as used in the original tests. The time required to kill the organisms is the standard of comparison.

I. *Bichloride of mercury solutions.* Bichloride of mercury in dilutions of 1:500, 1:1,000, 1:2,000, and 1:10,000 were used. Harrington's solution is also considered here. In the first series all the solutions showed effective germicidal action in one minute with the exception of the 1:1,000 dilution of $HgCl_2$, which killed in five minutes. In two controls, however, none of the solutions was effective in one minute, nor in two minutes with the exception of Harrington's solution in one instance. Bichloride, 1:1,000, was only effective in fifteen minutes; while in a dilution of 1:10,000 the organisms were killed in thirty minutes. Harrington's solution, which was so efficient in the original test, showed wide variation in the controls, in one instance taking effect in five minutes and again there was no inhibition in twenty-five minutes.

II. *Silver salts and compounds.* Here are included silver nitrate in strengths varying from 0.5 per cent to 10 per cent, together with argyrol 10 per cent and protargol 10 per cent.

Again we would call attention to the wide variation in the results. One-half per cent $AgNO_3$ in no instance would effectively penetrate the celloidin, even when allowed to act for a period of three hours. The one per cent solution was likewise ineffectual except in one instance when the plant made in one hour was sterile. Two per cent $AgNO_3$ showed considerable variation: once there was complete inhibition in ten minutes, while in a second instance the organisms were still alive and showed only a slight inhibition after three hours. Ten per cent solutions of silver nitrate showed germicidal action in fifteen to twenty minutes. The organic silver preparations, argyrol and protargol, each in 10 per cent strength, were in no case able to penetrate the membranes effectively.

Thinking that possibly the marked failure to take effect of such an excellent antiseptic as silver nitrate was due to the presence of the sodium chloride in which the organisms were suspended, and the consequent formation of inert AgCl, an aqueous suspension of bacillus pyocyaneus was substituted. The results, however, did not justify this conclusion: One-half per cent and two per cent $AgNO_3$ were not effective in two hours; while the one per cent solution which had killed the organisms in saline suspension in one hour was not present in sufficient concentration to act in ten minutes. This anomalous result may be due to an undiscovered leak in the capsule. Ten per cent $AgNO_3$ was effective in one hour. Without doubt the concentration of the saline was so much less than that of the silver salt that only a small amount of AgCl was present to hinder the reaction.

To determine how soon the silver would actually penetrate the saline in the capsules, a series of chemical tests was made, using 0.8 per cent sodium chloride inside the membranes and the above-mentioned strengths of silver salts in the container. The time when the white AgCl appeared either inside or outside the capsules was noted. Diffusion took place in both directions and in eighteen hours the systems were practically all in equilibrium, but the intermediate stages were as inconstant as many of the results already noted on the bacterial suspensions. No conclusions can be drawn from these observations aside from the fact that osmosis does take place.

III. *Phenol solutions.* This series consisted of 5 per cent phenol in water, 5 per cent phenol in 0.8 per cent saline, camphor and phenol (1:3), and 98 per cent phenol. Phenol in saline was used, as it has been shown that the presence of sodium ions increases the penetrability of this germicide. Camphor-and-phenol has been extensively used in veterinary surgery under the trade name of "Campho-phenique" and has been lately introduced in some clinics for use in human surgery. It is prepared by rubbing in a mortar one part of gum camphor with three parts of phenol crystals, which forms a thick syrupy liquid. As a control for the last-mentioned antiseptic, phenol crystals were rubbed with just enough water to make a thick syrup.

A 5 per cent aqueous solution of phenol was effective once in fifteen minutes, again in two hours, and the third time not in twenty-five minutes, beyond which time this control was not extended. A 5 per cent saline phenol solution showed no increase in diffusion velocity over the aqueous solution and the variation was as marked as with the latter. The camphor-and-phenol averaged a little better than the strong phenol alone. In the first experiment both were effective in ten minutes; in controls, neither showed germicidal action in twenty-five minutes; but in a third control the strong phenol gave results in ten minutes while the camphor-and-phenol was effectual only in twenty-four hours.

IV. *Miscellaneous solutions.* Peroxide of hydrogen was very slow to penetrate the capsules, although the effects happened to be constant in two tests. This germicide was present in sufficient concentration to kill the organisms in forty-five minutes.

Aluminum acetate, which is quite extensively used in our clinics as a wet dressing, was found to have no germicidal action in twenty-four hours.

Likewise balsam of Peru failed to show any such effect; but even though it should have antiseptic action, the fact that it consists of a large number of substances, many of which are colloids, would probably prevent its complete diffusion through a colloidal membrane.

An attempt was made to contrast the action of aqueous and alcoholic solutions of iodine, on bacillus typhosus. The official tincture of iodine penetrated in one minute and no growths were obtained. When this was controlled by placing starch solution inside one of the capsules, the "starch reaction" was obtained in one minute. The alcoholic solution was contrasted with an aqueous iodine solution containing I, 7 gm.; KI,

5 gm.; H_2O, 100 ccm.; and the results were identical with the former test; 95 per cent alcohol effectively penetrated in ten minutes.

It needs but a hasty glance at these results to see that they are far from constant and fall far short of the well-tabulated values seen in the report of the originators of the method. It is true that many of the antiseptics killed the organisms by diffusing through the membranes when allowed to act for a sufficiently long time, but this time varied greatly. Evidently some factor in the experiment was inconstant. This was not the solutions, for both the antiseptic and the bacterial suspension were from the same stock. The organisms were all from twenty-four-hour agar slants grown at constant temperature; the suspensions were made in the same manner and the amount of suspension accurately measured. The temperature of the room was probably fairly constant. The thickness of the capsule, however, could not be accurately measured. The membranes were made from the same celloidin stock, but it is very probable that the amount of celloidin adherent to the mould varied beyond control. Seelig and Gould recognized this possibility, and give data to show the effects of thick and thin capsules on the diffusion velocity. Abel (9) states that the thickness of the celloidin has no effect upon the rate of diffusion, but his observations were made with moving fluids. He says, however, that there is a layer of stasis next to the membrane which keeps this factor constant. Moreover, his observations were made hourly, and possibly the diffusion velocity would vary within the limits of an hour. At least, we are forced to ascribe the inconstancy of our results to the lack of uniformity in the thickness of the capsules or to differences in the resistance of the organisms.

The following conclusions may be drawn concerning the method as we have employed it.

1. Osmosis does take place between fluids using celloidin as a semipermiable membrane.

2. If allowed to act for a sufficiently long time most antiseptics of a crystalloid nature will penetrate and kill organisms.

3. The time of reaction is not a suitable standard of comparison for the value of an antiseptic unless all the experimental factors can be kept constant.

4. We have found it practically impossible to keep the thickness of the celloidin membranes, and possibly the temperature, constant.

5. The conclusions of Seelig and Gould are open to criticism in that they did not sufficiently control their experiments, regarding a single observation as conclusive.

As the experiments were undertaken to demonstrate the comparative efficiency of antiseptics acting upon the skin, we also tried a limited number of experiments using living animal membranes according to the technique described by Seelig and Gould.

In all our experiments rats were used, as they are cheaper and more easily handled than rabbits. After a few preliminary tests with the whole thickness of skin and fascia, it was found necessary to make small pockets in the membrane, having for their floor the superficial skin layers only, as the first membranes were too thick to allow rapid osmosis. Into these pockets a thick emulsion of organisms from the water of condensation of agar slants was rubbed and the whole membrane depressed by means of a glass slide into a container of antiseptic solution as already described.

To be sure that our membranes were actually alive, the circulation was tested at frequent intervals. This point is of particular importance, as it was shown by a series of tests that diffusion takes place much more rapidly through dead than living membranes. Whether this is due to the mechanical removal of the antiseptic ions by the circulating blood and lymph, or whether it is due to some property of living cells, or to both factors combined, need not here be considered. Suffice to say, in many of our flaps there was practically no circulation in so short a time as forty minutes. Accordingly, unless conditions are ideal so far as the circulation in the flap is concerned, no satisfactory conclusions can be drawn when the antiseptics are allowed to act for periods longer than forty minutes.

Data on living membranes. When bichloride of mercury in dilutions of 1:500 and 1:1,000 was allowed to act through living membrane on pockets

containing bacillus typhosus streptococcus, staphylococcus, and bacillus prodigeosus, no inhibitory effect was noted in forty-five minutes, nor did the addition of 5 per cent acetic acid show any accelerating effect on its diffusion velocity. These tests were all adequately controlled and in only a single instance was a negative culture obtained.

In a series similar to the one just described, dead membranes were substituted. These were taken from animals which had died during the induction of anæsthesia. The organisms were killed in periods varying from five to ten minutes, but one organism (bacillus prodigeosus) never gave negative plants. The reaction between the mercury and protein may perhaps be hastened by death, by the mechanical factor of lack of removal by the circulation already mentioned, or by the toxic effect of an overdose of ether vapor in solution in the tissue,— any or all of these factors might explain the accelerated antiseptic action of bichloride on the dead membrane.

A 1:1,000 solution of iodine in commercial benzine in one instance immediately penetrated the living membrane, but a control with the so-called petroleum ether failed. Whether the latter is lacking in penetrating power or whether the method is at fault we are not prepared to say, but at any rate no effective action was observed in one hour. This solution was also tried with a dead membrane from a rat which had died thirty minutes previously during the induction of anæsthesia. For streptococcus and staphylococcus, the mixture showing a marked affinity as germicidal action took place in five minutes; but on bacillus typhosus, and bacillus prodigeosus it had no effect in thirty minutes. This selective action for the two cocci with a dead animal membrane was apparently not an accident, for in other instances using other antiseptics the cocci were killed while the bacilli were unharmed.

The other antiseptics tried — namely, one per cent picric acid in acetone, camphor and phenol (1:3), tincture of iodine (U. S. P.), and an aqueous solution of gentian violet — also showed no bactericidal effect within the time of observation. Gentian violet, which Churchman (10) has shown to be such an efficient germicide *in vitro*, is undoubtedly changed by the animal tissues so that it loses its germicidal properties. Tincture of iodine, which is so efficient clinically and also with the celloidin capsule, showed a surprising inability to penetrate the superficial skin layers and act upon the bacteria contained in the subcutaneous pouches.

These results would hardly recommend the method as an efficient test of an antiseptic acting upon the skin. The series of experiments was large enough to eliminate a faulty technique. That osmosis does take place cannot be denied; but that it can take place within three minutes, as reported by the authors of the method, is extremely doubtful. In these experiments it was found that periods of one hour, or in many instances longer, were necessary for effective penetration, and this is, of course, too long to parallel clinical conditions.

The "skin-flap method" for testing the efficiency of an antiseptic is inadequate for the following reasons:

1. The conditions in the living skin flap do not parallel those in the celloidin membrane and no analogies between them can be drawn. Many phenomena of the living skin are not reproduced in an artificial membrane.

2. We have found it impossible to control the thickness of both animal and artificial membranes.

3. After varying periods of time the circulation in the living flap is arrested and then the membrane no longer exhibits characteristics of a viable flap.

4. It is difficult to obtain an even distribution of organisms so that all parts of the suspension are simultaneously affected. Although the authors of the "skin-flap method" are not explicit upon this point, we infer that they pour several cubic centimeters of bacterial suspension into the skin pouch. Only those organisms, consequently, in immediate contact with the membrane would be affected by the solution, or at least not until the reaction had continued for some time and the diffusing solutions were approaching equilibrium. This objection would certainly apply to the celloidin capsules in which 2 ccm. of saline suspension were used.

5. The time of reaction is not a trustworthy standard of comparison, as in properly controlled observations we cannot demonstrate that it is a constant factor.

In the present state of our knowledge, the efficiency of an antiseptic cannot be attributed solely to physicochemical conditions such as the concentration of the antiseptic solution, its solvent power upon the membrane, or its osmotic tension. Probaby, the character of the living and dead animal membranes largely determines the rate of diffusion, as does also the thickness of the artificial celloidin membranes. Thus far no method has been devised which determines the comparative efficiency of antiseptic solutions under conditions obtaining in a modern operating room.

There is reason to believe that several of these factors are at work, either singly or in combination, to produce the antiseptic effect. Moreover, it is quite probable that the selective action of the bacterial protoplasm for a particular antiseptic may play an important rôle in this problem, as has been beautifully demonstrated by the action of gentian violet and dahlia for a particular group of organisms, or by the affinity of salvarsan for the treponema pallida.

In conclusion I wish to thank Prof. J. M. Flint for many helpful and valuable suggestions in these experiments.

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DEPARTMENT OF TECHNIQUE

A NEW METHOD OF ROUND LIGAMENT FIXATION

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Surgeon to St. Vincent's Hospital

IN the hope of interesting surgeons sufficiently to give it a trial and express their opinions as to its worth, I wish to describe an operation I recently devised and performed for fixation of the round ligaments. Several surgeons to whom I explained it expressed very favorable opinions in regard to it, and one used the method in two cases of his own. It is so simple that the steps can be described in a few words.

The abdomen is opened in the usual way, the round ligament separated, and by means of a ligature carrier which has been thrust through the rectus muscle, drawn to the surface of that muscle. Thus far the operation is similar to that of Montgomery's. At this stage, however, it differs, and it is this difference which causes good results to be more permanent. Instead of ligating the loop of round ligament to the small opening made in bringing it through the rectus by the ligature carrier it is held up by an assistant, and the surgeon, either with scissors or scalpel, commencing at the site where the ligament has been drawn through, cuts for about three quarters of an inch in length in the direction of the fibers and towards the pubis the rectus muscle and underlying tissues, including the peritoneum. The assistant then holds at the upper angle of this incision one side of the loop of round ligament and places and holds the other side in the lower angle. While so held it will be observed that the loop arches over the incision made in the rectus, one pillar being in the upper, the other in the lower, angle. The surgeon, working under this arch, sutures together with catgut the edges of the incision in the rectus lying between the pillars held in the upper and lower angle, being careful

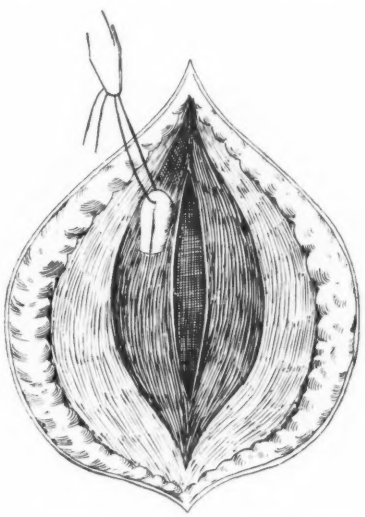


Fig. 1. Round ligament, after having been drawn through rectus muscle, is held up by assistant while surgeon incises rectus and underlying tissues.

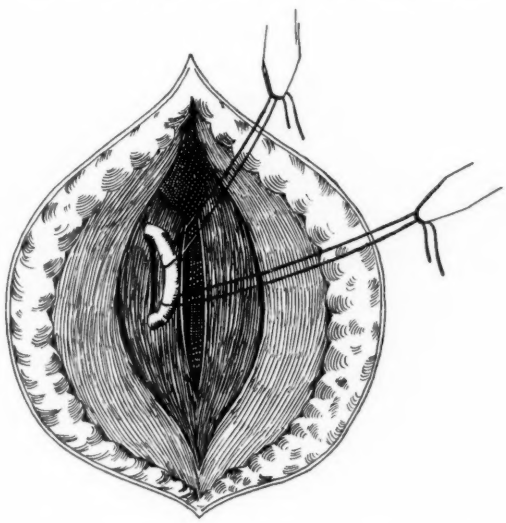


Fig. 2. Round ligament held in new position by assistant while surgeon sutures the incision in rectus and underlying tissues.

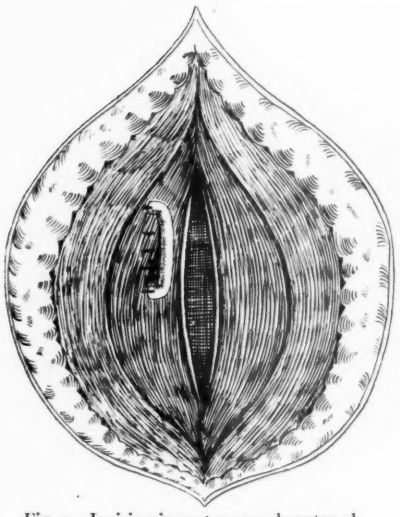


Fig. 3. Incision in rectus muscle sutured.

to bring together the fibers of the muscle in the same apposition they were before incised. This leaves the loop of ligament resting on a bridge of muscle three quarters of an inch long, one end of the ligament passing into the pelvic cavity through a small opening in the lower angle of the incision and the other through a similar opening in the upper. Once the muscle and underlying tissues are united it is impossible for the ligament to get away from its moorings and drop back into the pelvic cavity. The two ends, three quarters of an inch apart, pass into the pelvic cavity through individual openings only sufficiently large to allow each to pass, while the loop between rests on solid muscle. I pass the first suture through the rectus close to the round ligament at the upper angle, and the last suture through the rectus close to the round ligament at the lower angle so as to make the openings through which the ends pass no larger than that originally made by the ligature carrier in drawing the ligament through the muscle. Although it is not necessary, the end emerging from and the one descending into the pelvic cavity may be anchored at its site by passing one suture through it and the rectus muscle. The opposite round ligament is, of course, treated in the same way. The closing of the general abdominal wound is similar to that of other laparotomies.

RUBBER GLOVES

A Technique of Mending

By FREDERIC J. COTTON, M. D., Boston

SOME trace of Yankee thrift must be responsible for my economy in rubber gloves. Over a dozen years ago I taught the nurses at the Children's Hospital and the City Hospital the technique of mending that has since come into such general use; though such general use is due to the independent initiative of many surgeons beside myself.

For four or five years, however, I have used and have taught to operating floor nurses at the City Hospital and the Boothby Hospital a scheme which saves time and trouble and results in real economy.

Everyone who has mended gloves knows that the real difficulty lies in the curling up of the rubber of the patch and of the rubber edges of the tear when it is once moistened with the cement. This occurs, if the tear is at all large, to an extent that makes considerable repair impracticable; and this is true with *all* effective cements, though some are much better than others in this regard.

The way of getting around this is as follows:

Take an ordinary library filing card, spread it rather heavily with ordinary library paste, and paste on it the rubber tissue (dentists' "rubber dam" of light weight is what I use); smooth this flat, and let the paste dry.

Then when a patch is needed, cut one out, rubber, card, and all, to fit the tear. Put the glove on the hand, inside out, moisten the patch with cement, let it dry for a few seconds, fit it on where it belongs and press it home as hard as you can.

If the tear is large it is easier to lay the moistened patch down and fit the edges of the tear to it, then press. That is all there is to it, except for powdering the glove, and laying it by. Later, soak it in water, and the bit of card comes away as the paste dissolves. You have a secure patch, adherent clear to its edges, *flat* and water-tight, and fit to stand boiling as well as any patch is. The trick is easy, and worthy, I think, of wider use than it has had to date.

THYMIC ASTHMA SUCCESSFULLY TREATED BY X-RAYS

Report of Two Cases

By H. J. MORGAN, M. D., and H. W. DACHTLER, Toledo, Ohio

TO the small number of cases of thymic asthma reported as successfully treated by X-rays we wish to add the two following, believing that such treatment skillfully administered should be more generally employed. The röntgenograms showing the reduction in the size of the gland following treatment are, we believe, unique.

Case 1. Zoe G., age 20 weeks; sent in for adoption to Maternity and Children's Hospital, December 17, 1913. Only history obtainable noted that she was a seven-months' child, has had colds and snuffles since early life, and two attacks of wheezing and strangling, cough and dyspnœa, during the last month. Her voice is clear; during sleep the difficulty in breathing is less. When picked up or when exposed to cold the difficulty is greater. She has difficulty in swallowing.

Examination. Weight 7¾ lbs. Having a suffocative attack; face blue; respiration, 90; marked inspiratory stridor, with slight cough. Nose, throat, eyes, and ears normal. Auscultation: rattling, bleating, and wheezing; fine and coarse mucous râles over whole chest, front and back. Breathing "resembles the noise of boiling water." While listening, breath-sounds stop for a few seconds; then air is heard to enter. There is sinking in of suprasternal and substernal region on inspiration and simultaneous bulging of anterior fontanelle. Percussion over chest, normal. Heart action, 100; no abnormalities. Percussion over thymus shows right border two centimeters to right of sternal border at level of second rib. Left border at left sternal margin. Thymic dullness below merges into that of heart. These findings verified later by röntgenogram by Mr. Dachtler (Plate 1). Other physical findings negative.

Diagnosis. Adenoids, enlarged bronchial glands, and other causes of laryngeal stenosis being excluded, a diagnosis of thymic asthma is made.

On December 24, 1913, first treatment by exposure to X-rays, after which she seemed more distressed and refused food, but improvement in breathing noticed the next day. December 26th: Second treatment. After-effect not so noticeable, but voice is feebler. December 27th: Third treatment. No longer continuously cyanosed; breathing much easier. Suffocative attacks, which have occurred six to seven times in twenty-four hours, occurred only twice yesterday. This and preceding treatments given at a distance of twelve inches, through leather filter only — one Holzknecht unit each. December 28th: Fourth treatment, one-half Holzknecht unit. Almost no asthma; suffocative attacks (slight) only when exposed to cold; almost complete aphonia. Examination shows

Plate 1, Case 1. Thymus enlarged to the right.

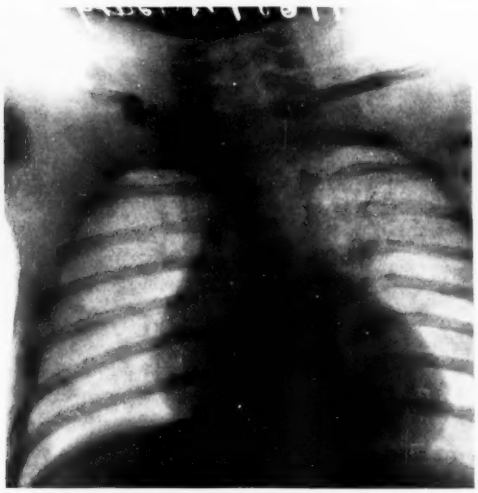


Plate 2, Case 1. Six X-ray exposures. Absence of thymic hypertrophy.

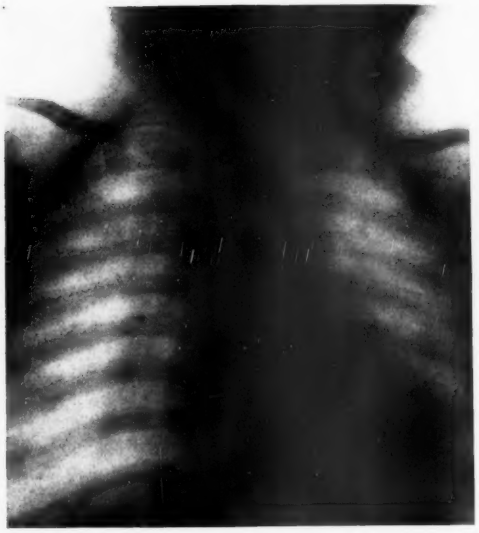


Plate 3, Case 2. Thymus enlarged to the left.

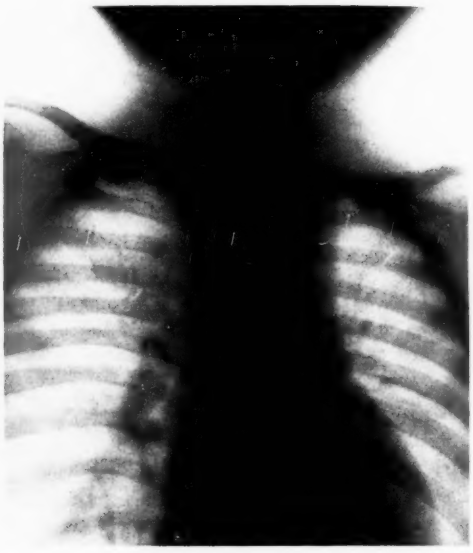


Plate 4, Case 2. Four X-ray exposures. Röntgenograms taken three months later. Absence of thymic hypertrophy.

incomplete apposition of vocal cords due to swelling. No paralysis.

Blood examination. Red corpuscles, 5,430,000; white corpuscles, 15,500; polynuclears, 55 per cent; Large lymphocytes, 10 per cent; small lymphocytes, 31 per cent; eosinophiles, 4 per cent.

January 3, 1914: Fifth treatment, one Holzknecht unit. No reaction; continued improvement. Respiration 30, clear and free, no cyanosis or dyspnœa; no suffocative attack for four days. Aphonia still present. January 13th: Sixth and last treatment, one-quarter Holzknecht unit. Practically no symptoms of former trouble; voice returning.

Blood examination. Red corpuscles, 5,200,000; white corpuscles, 7,000; polynuclears, 50 per cent; large lymphocytes, 22½ per cent; small lymphocytes, 25 per cent; eosinophiles, 2½ per cent.

January 20th: Röntgenogram shows absence of thymic hypertrophy (Plate 2). All symptoms of asthma have disappeared, she takes food readily, and her voice has fully returned. She has lost five ounces in weight. May 20th: No recurrence of symptoms; now about four months since treatment was discontinued.

Case 2. Martin K., age 18 months; seen in consultation January 10, 1914.

Only child of healthy parents. Well until four months old, when he had frequent colds, with wheezing inspiration, shortness of breath, and cyanosis. He was better the following summer, but last September when fourteen months old began to have trouble again. He has had several suffocative attacks, sometimes brought on by exposure to cold, sometimes by handling, and between times has remained cyanotic, with slight cough and always dyspnœa. His breathing is always easier at night. He has slight difficulty in swallowing. The trouble has been attributed to adenoids and their removal advised.

Examination. There is marked inspiratory stridor and slight cyanosis. He coughs a little and evinces considerable distress afterward. The chest bulges slightly above; there is inspiratory depression of epigastrium. Eyes, nose, and ears normal. Small amount of adenoids present. Auscultation gives typical bubbling breath sounds slightly diminished on right side; rate 40. He breathes through the nose with the mouth shut. Percussion over chest normal; heart action, 90; no abnormalities. Percussion over thymus gives left border 2½ centimeters to left of sternal border at second rib, and extends downward and to the left to the third rib. Right border at right sternal margin. Thymic dullness below merges into that of heart. Findings verified by röntgenogram by Mr. Dachtler (Plate 3). Other physical findings negative.

Blood examination. Hæmoglobin, 70 per cent; red corpuscles, 5,000,000; white corpuscles, 22,000; polynuclears, 35 per cent; large lymphocytes, 17½ per cent; small lymphocytes, 42½ per cent; eosinophiles, 5 per cent.

Diagnosis. While he has adenoids, the fact that he is not a mouth breather and that his breathing is better at night seems to exclude these as a cause. Having also excluded enlarged bronchial glands, and no other cause for stenosis being apparent, a diagnosis of thymic asthma is made.

January 11th: First treatment by X-ray, and subsequent treatments on the 13th and 15th, at a distance of 12 inches, through leather filter only—one Holzknecht unit each. Last treatment given on the 19th—one-half Holzknecht unit. Improvement noted after the third treatment; and as all symptoms disappeared soon after the fourth treatment, the family declined to bring him for more exposures.

Röntenogram taken May 1st (Plate 4), more than three months after treatments discontinued, shows absence of hypertrophy of the thymus. Child has remained free from symptoms.

ELECTROTHERMIC COAGULATION AND RÖNTGEN THERAPY IN THE TREATMENT OF MALIGNANT DISEASE [1]

By GEORGE E. PFAHLER, M. D., Philadelphia

SINCE I have devoted most of my professional life to the study of röntgenology and am now to address you who have devoted most of your time to the study of electrotherapeutics and its allied branches, it is fitting that I should choose as my subject one which will show the effect of combining these two great fields of medical effort in the treatment of malignant disease.

The method consists in the complete destruction, or the removal, of all visible and palpable malignant disease by means of the d'Arsonval current, followed, or at times preceded, by full doses of the röntgen rays, given from as many different fields of entrance as is possible, so that as much irradiation is produced as though the rays alone were depended upon for the cure of the disease. In this way one is attacking the disease by the two most powerful forces known for the treatment of malignant disease, either of which alone is often sufficient to cure malignant disease.

To Nagelschmidt and Doyen belong the credit of introducing first the use of the high-frequency currents for the coagulation of tumor-tissue between the two poles of the d'Arsonval current under the terms "thermopenetration" or "exochleation." The credit of developing röntgen therapy to a high degree of efficiency belongs to many men, each of whom has contributed some factor of importance. I believe, however, that by skilfully combining the two, we may be able to prevent many failures that are encountered by either method alone, thus almost doubling our total results.

TECHNIQUE

The technique of the electrothermic coagulation is somewhat similar to that described by Nagelschmidt and in principle is identical. The *d'Arsonval current* is used, and an *instrument* is necessary which will generate from 1,000 to 2,000 Ma. of current. The amount of current will, of course, vary with the amount of destruction of tissue necessary.

The two electrodes are used, attached to the two poles. We, of course, know that the d'Arsonval current is alternating in character. The shape and character of the electrode will vary with the character of work required. For instance, if one desires to remove a portion of a lip, I would use, on the inside, a ball electrode about three-eighths of an inch in diameter, and on the outside, a needle-point electrode. Then I would outline the area of the diseased tissue to be removed, by allowing the current to flow from this point toward the ball electrode on the inside, and I would then coagulate the entire diseased tissue. At first I depended upon the needle electrode actually to carve out the diseased tissue, but now I find it simpler to cut this away with a pair of curved scissors, after coagulation, always cutting within the coagulated tissue. In this way there is no bleeding, and the edges are completely sealed off. The blood-vessels and lymphatics are at no time opened, which I believe to be a distinct advantage in the prevention of metastasis and ultimate cure of the patient. In destroying an extensive lesion in the cheek, I use a flat electrode, one inch in diameter, on the inside, and a point electrode on the outside. In destroying a portion of the tongue I have used two point electrodes. The electrodes are held in contact with the tissue.

One must always be as sure as is possible to destroy the entire diseased area, for there is danger of rapid extension from the periphery if all the disease is not destroyed — unless it is possible to control this tendency by the deep röntgen therapy. The tendency to the increased rate of growth in areas not removed by this process, or by operation, is probably due to the increased congestion which is brought about by the subsequent reaction.

Anæsthetic. In this extensive destruction the pain is intense, and some form of general anæsthetic is always necessary. For this, one may use ether or any of the general anæsthetics. For mouth cases, however, in which I have had most experience, I find that ether causes so much mucus and congestion about the mouth that the difficulties are increased. First, because the disease generally limits the degree to which the mouth can be opened, and the visible field is further decreased by the congestion involving the tongue and mucous membrane. Second, the mucus carries away, or distributes the current somewhat, and thus the area of destruction is less sharply defined. Then, too, one must always consider the possibility of ignition of the ether

[1] Presidential address delivered before the American Electro-Therapeutic Association, at Battle Creek, Michigan, September 15, 16, 17 and 18, 1914.

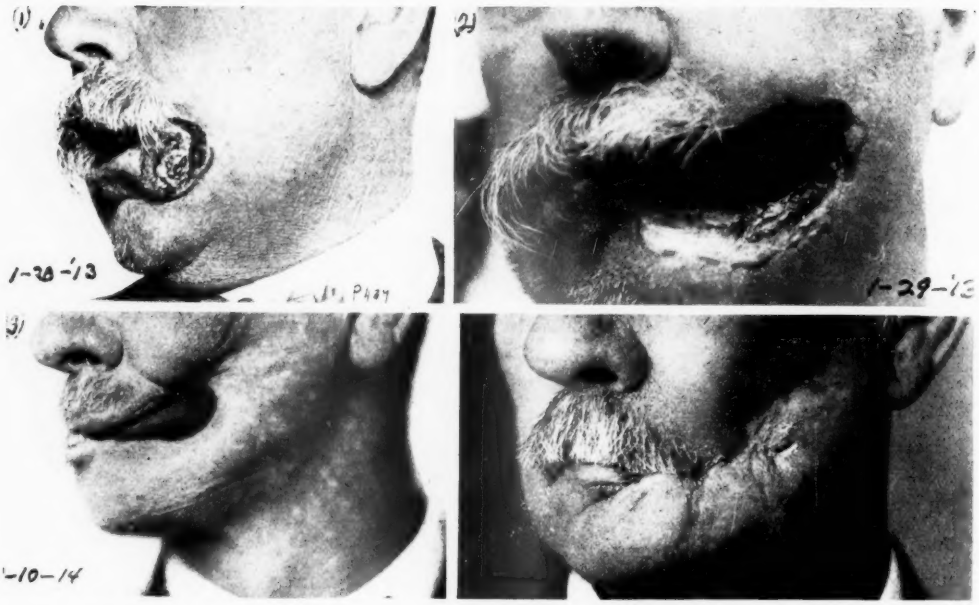


Fig. 1. Epithelioma inside of mouth. Twelve years.
Fig. 2. After electrothermic coagulation and slough.
Fig. 3. Healed.
Fig. 4. After operation for closing the mouth.

and an explosion. Therefore, in most cases, I use a hypodermic injection of one, or one and a half tablets, each of which contains hyoscine hydrobromide gr. 1:100, morphine hydrobromide gr. 1:4, and cactoid gr. 1:64. So far this has given no untoward symptoms, but very satisfactory results. In those cases in which there has been an habitual use of alcoholics, this is likely to be insufficient, and in such instances I have had to add ether.

DEEP RÖNTGEN THERAPY

Object. The object of the röntgen therapy is to control or destroy the outlying cells or metastases that may be missed in the coagulation process. Therefore, the treatment must be thorough and given with the understanding that disease may still be present; for if one is sure of having destroyed all of the malignant disease, there is no object in adding the röntgen therapy. This treatment must always be given with the technique used for deep disease, for one should never leave any superficial or visible disease behind.

Time of treatment. I commonly precede the tissue-destruction by a series of treatments or doses, given through as many areas as is possible, covering the entire periphery and glandular areas which are likely to be involved by metastasis. In two weeks, after the destruction of the disease, this series of treatments is repeated and again subsequently at intervals of three weeks or longer, as often as seems necessary from the nature and the extent of the disease. When röntgen therapy does not precede the electrothermic coagulation, one should follow it with these treatments just as soon as the patient can be moved to the laboratory, which is usually within a day or two.

The *skin dose* must be carefully measured, so as to give all that the skin will tolerate without doing damage. This is the erythema dose, and when measured by the Kienboch quantimeter, it equals 10 X of unfiltered rays; measured by the Saboraud and Noire pastilles, the erythema dose is recognized by tint "B"; measured by the Holzknecht radiometer, the dose equals 10 units. When the rays are filtered through three millimeters of aluminum and one-eighth of an inch of sole leather under the aluminum, and when the rays are given from a tube producing uniform, highly penetrating rays, 7–8 Benoist, the dose can be increased to 20, measured under the filters. This alone multiplies the deep effect by three.

The *skin area* and the *number* of *areas* through

Fig. 5. Epithelioma of nose nine years, and after unsuccessful treatment with plaster.

Fig. 6. After electrothermic coagulation and röntgen therapy.

which each dose is given will vary with the extent and depth of the disease, the amount of, or tendency to, glandular metastasis, and the degree of malignancy. The size of each area will depend upon the number of points of entrance required and the extent and depth of the disease. The deep effect is multiplied by the number of points of entrance. For instance, if the surface of the skin is divided into twenty-five areas and there is given through each area a full dose directed toward the center of the disease, this center gets twenty-five times as much rays as if the whole area of skin were covered at once. It is self-evident that it requires twenty-five times as long to treat the patient through these twenty-five points, as if the whole area of skin were treated at once. Therefore, the expense is also increased. Much of the end-result will depend upon the judgment of the röntgenologist in planning this treatment, as well as upon his skill in executing the treatment.

The amount of treatment that can be given through any specified area of skin is spoken of as a *dose*. The number of *doses* required to be given in order to cover the entire field is spoken of as a *series* of *doses* or *treatments*. The *interval* between any two series of treatments or doses should never be less than two weeks, and generally it is safer to allow three weeks. The length of this interval will vary with the degree of malignancy. When one is fighting a severe and advanced case of malignancy, I believe that one is justified in taking some risk of a dermatitis, rather than give too little and allow the disease to progress. The *number* of series of treatments required will vary with the individual case. Generally I repeat every two or three weeks for three or more series. Then, if all seems well, the interval is rapidly increased.

The *quality* of rays used is measured chiefly in its degree of penetrative power according to one of the scales. For example, measured by the Benoist penetrometer, it should register 7 to 8. A tube should be used which will give out this quality of rays continuously. The Coolidge tube will do this when carefully controlled. The time required to give a dose will depend upon the amount of current that can be passed uniformly through the tube without causing a variation in the vacuum. Filters must always be used in this character of röntgen therapy. At present, I use three millimeters of aluminum and under the aluminum one layer of sole leather. This filtration allows one to increase the value of deep radiation several times.

Cases suitable for this combined form of treatment. (1) Those cases in which there is a considerable area of malignant tissue, which can be removed *en masse* and which is too great to be destroyed completely by the electrical desiccation described by Clarke. For small superficial epitheliomata, warts, moles, and birthmarks, I much prefer the desiccation method.

(2) Epitheliomata involving the deeper portions of the lip, cheek, tongue, or alveolar process, especially those which have been treated for a considerable time with the röntgen rays, without success. Epitheliomata on other parts of the body, which are large, and especially if they must be allowed to heal by granulation.

(3) Old adherent scirrhous carcinomata of the breast in which there is no evidence of metastasis, and which are considered inoperable by surgical means.

DISADVANTAGES OF THE TREATMENT

1. There is complete destruction of all the tissue between the two electrodes. Therefore, there is no chance of saving the blood-vessels or nerves which are in close proximity to the disease.

2. It leaves an open area, which is healed by granulation, but at times this healing must be

Fig. 7. Epithelioma of lip one year. Before electrothermic coagulation.

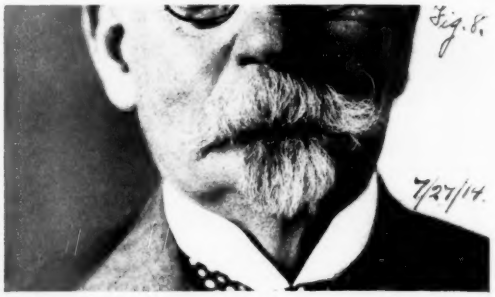


Fig. 8. Healed after electrothermic coagulation and deep röntgen therapy.

followed by a surgical plastic operation to close the mouth or to correct some deformity.

ADVANTAGES

1. There is complete destruction of the local malignant disease.

2. This is accomplished without opening the blood-vessels or the lymphatics, and I believe that this method of treatment is less likely to be followed by a recurrence or metastasis.

3. The wound heals with a smooth, soft scar, which resembles skin very closely.

4. At times one is enabled to apply this combined treatment in surgically inoperable cases.

CASE 1. Mr. J. L. P., age 58 (Figs. 1, 2, 3, 4). Referred by Dr. H. W. Dachtler, of Toledo, Ohio, January 20, 1913. An epithelioma had been growing on the inside of his left cheek for twelve years. This had been treated in a small town by the röntgen rays, for nearly ten years. Under active treatment by Dr. Dachtler, it nearly disappeared. The treatment was interrupted. A recurrence then developed, which would not yield to the röntgen rays. When he came to me the disease involved half of the upper and half of the lower lip; it extended inside the cheek to the angle of the jaw, and on the outside of the cheek there was a cauliflower-growth about one inch and a half in diameter. The patient was given an injection of hyoscine, morphine and cactine, and all of the diseased area excised by electrothermic coagulation back to the angle of the jaw, and then by means of the Oudin current the disease, which extended beyond the angle of the jaw onto the mucous membrane, was destroyed. In the deep portions of the mucous membrane, at the angle of the jaw, there was a tendency to recurrence for thirteen months. This was destroyed repeatedly, and each time followed by a series of doses of röntgen rays. In all he received fifty doses of röntgen rays, and 125 milligram hours of radium treatment.

February 21, 1914, all evidence of the malignant disease had disappeared, and Dr. Ernest Laplace did a plastic operation for the closure of his mouth, with excellent result.

CASE 2. Mrs. M. C., age 60 (Figs. 5, 6), referred by Dr. John A. Boger, March 6, 1913. For nine years she had an epithelioma growing from the nose. It grew especially rapidly within the last year after unsuccessful treatment with a "plaster." The disease involved the lower half of the nose, including the mucous membrane, as well as the skin. (See photos.)

The diseased area was removed by electrothermic excision, and afterward treated by röntgen therapy — six doses. The last treatment was given May 7, 1913. An excellent result was obtained, and she has remained well.

CASE 3. Mr. A. P. U., age 63, was referred by Drs. Neal, Murray, Gleason, and Warmuth (each separately) as an inoperable and hopeless case. He came to me March 7, 1913, having suffered from soreness in the region of the tonsil, and floor of the mouth, for only ten weeks. He noticed soreness in replacing his artificial teeth. It is likely that the irritation of this plate was the cause of this epithelioma. I found malignant disease involving the tonsil, the anterior pillar of the fauces, the right lower alveolar border and the floor of the mouth, extending forward one and one-half inches.

The disease was completely destroyed by electrothermic coagulation, in this instance using a large pad 8 inches by 12 inches, on the buttocks, and a point electrode, in the mouth. This was followed by deep röntgen therapy. On March 21, all parts seemed to be smooth, soft, and free from malignant disease. A portion of the alveolus was dead bone. At my request this was removed by Dr. Warmuth, and the patient was sent home.

April 29th, he returned apparently free from all evidence of the disease. Drs. Gleason and Warmuth examined him, and could find no evidence of disease. He remained apparently well six months, until October 13, 1913, when a small ulcer, one-fourth inch in diameter, developed. At first I was uncertain whether this was an ulcer due to my röntgen and radium therapy or due to the disease, for it did not seem to have an indurated base and margin, being in the angle of the jaw. This should have been thoroughly destroyed at once, but I hesitated until there was no uncertainty as to the diagnosis of malignancy, after which I was unable to control the disease by any means. He died recently.

In this case, what promised to be a brilliant success proved a failure, because of my timidity. Consultation did not help me in my early diagnosis of the recurrence.

CASE 4. Mr. J. S., age 52. Referred June 5, 1913, by Dr. W. E. Hughes. An epithelioma had been growing on the left side of the tongue for two months, and at this first visit the growth involved about one-fourth of the tongue. He also had metastasis in the left submaxillary region. The disease of the tongue was destroyed by electrothermic

Fig. 9. Epithelioma unsuccessfully treated for two years. Had been growing many years. It extended down to the joint.

Fig. 10. After electrothermic coagulation and röntgen therapy. Crust came off later. He is well September 15, 1914.

coagulation. This was followed by deep röntgen therapy, with the hope of controlling the metastasis. The *tongue healed*, and *has remained well*, but the metastasis seemed to decrease for a time only, then increased, and is now in the terminal stage of metastasis in the chest.

In this case the local disease was successfully destroyed, and remained well, which proves that if he had come before metastasis had taken place, he would have recovered. To-day, I believe with our modern technique and improved equipment, even this metastasis might have been controlled.

Case 5. Mr. H., age 67, was referred by Dr. Joseph Gibbs, June 24, 1913, with an epithelioma of the lower lip (Figs. 7, 8). This was destroyed by the electric desiccation method first, and followed by röntgen therapy locally, but especially over the glands. A recurrence developed. It was again destroyed by the same method. A third recurrence developed, and he refused any further interference surgically, or other than the röntgen rays. Finally, February 19, 1914, he gave his consent to electrothermic excision, at which time I removed the entire lower lip, following the removal by active röntgen therapy, with complete recovery and very satisfactory results. (See illustrations.)

Case 6. Mr. C. S., age 78, was referred September 29, 1913, by Dr. J. W. McMonigal (Figs. 9, 10). He had a mole on his ankle for years. This had been epitheliomatous for two years, during which time he had been unsuccessfully treated by röntgen rays by one of my colleagues. He had been seen by Dr. John B. Deaver, who advised amputation, which was refused. When I first saw him, he had an epitheliomatous growth 2 by 2½ inches by 1 inch. (See Fig. 9.)

He was given an injection of hyoscine, morphine, and cactine, and this entire area destroyed. The disease extended down to the ankle-joint, and the destruction had to be carried into the capsule of the joint. This was followed by röntgen therapy. Because of his age, feeble condition, and the open ankle-joint, the ulcer was slow in healing, but was finally healed March 20, 1914. At no time was there any evidence of recurrence.

This case illustrates the type which is locally inoperable on an extremity. It also illustrates that a joint can be opened by this process, if necessary, and healing obtained even in a feeble old man.

Case 7. Mr. A. N., age 59, referred by Dr. John Elmer from Egg Harbor, September 19, 1913. An epithelioma had been developing on the left side of the tongue for several months. A section was removed two weeks previously, and found to be malignant. At the time of my examination, he had evidence of metastasis. The disease was locally destroyed by electrothermic coagulation. The metastasis was treated by the röntgen rays. The tongue recovered and at no time showed evidence of recurrence. The metastasis was probably held in check for a time, but finally increased and rendered the case hopeless.

Here, again, the local disease was successfully treated, but the metastasis, which had started, was uncontrolled. To-day there would be more chance of control of the metastasis, because of our improvement in technique.

Case 8. Mr. H. R. S., age 54, referred by Dr. J. R. Umstead, October 31, 1913 (Figs. 11, 12). He had an epithelioma developing upon the left side of the forehead for eight years. Was treated unsuccessfully by caustic pastes, carbon dioxide snow, röntgen rays and thorium paste. When I first saw him he had an epithelioma two inches in diameter, elevated a half-inch, firmly adherent to the bone, and there was ulceration of the outer table. The induration extended under the eyebrow (Fig. 11).

All of the disease was destroyed, even that extending under the eyebrow, without destroying the eyebrow, and it was necessary to destroy the outer table of the skull under the lesions. He was told at the first visit that this would have to be done, and that later the bone would have to be resected and a plastic operation done. This operation was performed and followed by röntgen therapy. The dead bone, which had been turned white by the treatment and which was dry and hard, showed signs of the formation of a sequestrum. It was removed by Dr. Warmuth, April 24th, including the inner table, which was soft. Microscopical examination showed no evidence of carcinoma of the softened bone. This operation was followed by a plastic operation by Dr. M. P. Warmuth, with a most excellent and satisfactory result (Fig. 12).

Case 9. Mrs. A. J. C., age 84, was referred to me November 18, 1913, by Dr. A. C. Stroup, for treatment of a vegetating epitheliomatous growth, involving the right

Fig. 11. Epithelioma eight years. Failure under all forms of treatment.

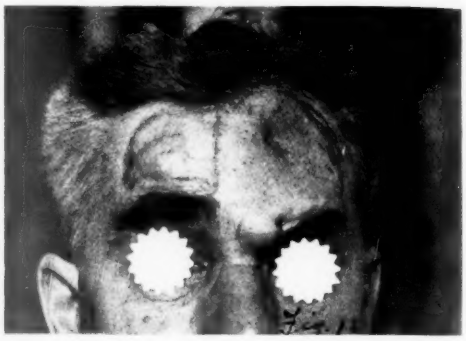


Fig. 12. Well after electrothermic coagulation, resection of dead bone, and a plastic operation. The small white area to the left of the flap is a small mass of dead bone which had not been removed.

alveolar border of the upper jaw. It had been growing three months, was two inches long, one inch wide, and three-fourths of an inch thick. It developed under the plate of artificial teeth, and was probably due to this irritation.

She was given an injection of hyoscine, morphine, and cactine, and the entire diseased area destroyed by electrothermic coagulation. At this time it was found that the disease involved the entire depth of the alveolar process, and extended into the antrum. She was given active deep röntgen therapy and radium treatment inside and outside the mouth.

There have been two recurrences since, which have been destroyed. I shall fail on this case ultimately, but even with failure, she has been made more comfortable than she would have been with a vegetative malignant growth filling the mouth.

CASE 10. Mr. R. K., age 44, was referred by Dr. Thomas Byrne, December 23, 1913, with an epithelioma of the floor of the mouth which had been growing at least three months. The disease included the under surface of the tongue, the floor of the mouth, the alveolar border and inner wall of the lower jaw from the bicuspid region on one side, to the bicuspid region on the other. Metastatic nodules could be felt in the submaxillary region on both sides. Dr. Stillwell Burns advised against any surgical interference.

Under an injection of hyoscine, morphine, and cactine, the malignant disease was destroyed the teeth removed, and the alveolar process and inner wall of the bone were destroyed. Then with bone forceps the dead bone was chipped off, curetted, and the surface again treated with a heavy Oudin spark.

This operation was followed by active röntgen therapy inside and out. All parts healed nicely, and all but one enlarged gland disappeared. In three months the surface of the bone which had been devitalized, was thrown off as a sequestrum. Strange to say, the mucous membrane had healed under the sequestrum, and the bone seemed healthy. At this stage it looked as if he would certainly get well. However, the one metastatic gland would not disappear, and now, at the end of six months, this gland has grown and is involving the floor of the mouth. There have been no other enlarged glands.

The noteworthy features of this case are — (1) That an absolutely hopeless case (by any other means of treatment) is rendered comfortable for six months, and free from symptoms for three months. (2) That carcinoma of the bone was locally destroyed with recovery of the remaining bone. (3) That the devitalized bone was thrown off bodily, with the healing of the mucous membrane over the surface of the healthy bone. (4) That all but one of the metastatic glands disappeared. (5) That the patient has been able to attend to his regular business, except during the first three weeks.

CASE 11. Mrs. B. McD., age 65, was referred by Dr. John A. McKenna, April 1, 1914, on account of an epithelioma two and one-half inches in diameter, involving the hairy portions of the scalp, in the right temporal region.

This was destroyed by electrothermic coagulation locally, and followed by a full dose of filtered rays over the entire area. The patient has not been able to return for further treatment, but the wound is nearly healed, September 6, 1914.

CASE 12. Mrs. K. L., age 68 (Figs. 13, 14), referred to me by Dr. W. L. Rodman, April 3, 1914, with a large, scirrhous carcinoma of the right breast. It had been growing five years. Had been treated by a plaster (Fig. 13). *This was firmly adherent to the chest wall* and was considered entirely inoperable by Doctor Rodman. We could detect no glandular enlargement in the axilla, or supraclavicular region. A röntgenogram of the chest showed the shadow of the tumor, and in addition a number of small dense glands along the mediastinum. On account of the absence of palpable glandular involvement, and with the possibility of mediastinal glands not being malignant, I considered my combined treatment applicable. It is in breast cases that I considered this method of treatment advisable.

Therefore, I destroyed the tumor by electrothermic coagulation, cooking from the surface downward, then shaving off the cooked malignant tissue until I reached the intercostal muscles. I had to work in this way very carefully for fear of penetrating the chest wall and lung. This was preceded and followed by deep röntgen therapy, and to-day, June 27, 1914, I can detect no evidence of malignancy, and the wound is flat, smooth, and two-thirds healed. The whole area is still very red. The patient is

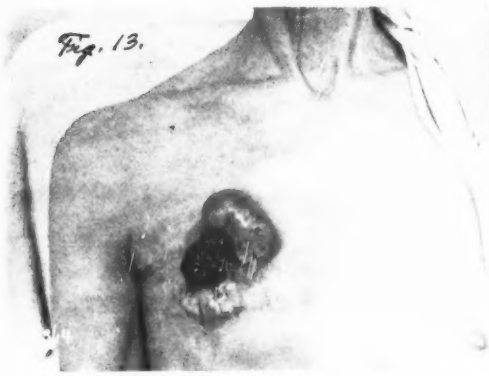


Fig. 13. Adherent scirrhous carcinoma of the breast. Growing five years. Had been unsuccessfully treated by a plaster.

Fig. 14. Healing by healthy granulation. See the smooth, soft scar, June 1, 1914.

free from symptoms, and has regained general health and strength. When examined by Dr. Rodman and myself Oct. 2, no evidence of malignancy could be found and the wound was almost healed.

The points of great interest in this case are — (1) That it was a scirrhus which had been aggravated by plaster treatment applied by a charlatan. (2) That it was inoperable. (3) That it was not suitable for röntgen therapy alone. (4) That it was completely and successfully destroyed by electrothermic coagulation and röntgen therapy.

CASE 13. Mr. C. H. H., age 55, was referred by Dr. Empson Bainbridge, April 20, 1914, with an epithelioma involving the right cheek, the angle of the jaw on the inside, the entire right lower alveolar border, and the floor of the mouth. There was one palpable gland.

The whole area was treated inside and outside by röntgen therapy, with eighteen full doses. Then the disease was destroyed by electrothermic coagulation. In a month there was some evidence of recurrence. This was again thoroughly destroyed by electrothermic coagulation. He then improved in his general health and looked well, but when examined September 4th a recurrence of about one-sixth of the extent of the original disease was found, and this was destroyed. I believe he has a reasonable chance of recovery.

CASE 14. Mr. J. G., age 51, was referred by Dr. William L. Rodman, March 8, 1913, on account of a large recurrent epithelioma on the back developing upon the scar of a burn received forty-seven years ago. Five months before he was referred to me after an injury, a tumor began to develop. One month previously the tumor was removed surgically. It recurred, and was again curetted in three weeks. At time of beginning röntgen therapy there was some induration at the edges. Under treatment this had practically disappeared June 23, 1913. He then stopped coming to the dispensary until January 20, 1914, when he had recurrent epithelioma covering about four square inches. This was completely destroyed by electrothermic coagulation, after which he was given four full doses of röntgen rays, which were repeated at the end of a month. At the end of two months there was no evidence of malignant disease. Since then he has not returned for examination and treatment.

CASE 15. Mrs. K. S., age 46, referred by Dr. Ernest Laplace, March 1, 1913; had a malignant growth under the tongue, eight months. Two months previously it had been excised. It promptly recurred, forming a tumor two inches long and one-fourth inch thick, lying between the tongue and the alveolar process. A section, examined by Dr. Eugene Case, showed it to be an endothelioma. It was totally destroyed by electrothermic coagulation. This was followed by twenty four full doses of röntgen rays. She grew careless about the treatment, and returned November 18, 1913, with a recurrence. She was given twenty-six full doses of röntgen rays, with a complete disappearance of the disease, and she has remained free now 11 months.

This case is of especial interest because — (1) It was considered inoperable by the surgeon. (2) It was a recurrent endothelioma. (3) It was destroyed, but, through carelessness of the patient, recurred. (4) The recurrence disappeared under massive doses of deep röntgen therapy.

CASE 16. Mr. J. L., age 45, referred by Dr. H. A. Cleaver, May 10, 1914. He had an epithelioma growing upon his lower lip two years. He was an alcoholic and a heavy smoker. For a year he was treated by the röntgen rays in another city. At the end of this time, the induration involved about one-third of the lower lip. There was evidence of repair and ulceration present. In such cases, I have found that further röntgen treatment is useless. I therefore removed about one-third of the lower lip by electrothermic coagulation, and followed this by deep röntgen therapy, locally and over the sub-maxillary region. There is at present no evidence of malignant disease. A plastic operation is now necessary to close the wound in his lip.

The points of special interest are — (1) That the patient had smoker's epithelioma for two years. (2) That it was treated unsuccessfully for a year with the röntgen rays by small fractional doses. (3) That the destruction was brought about by electrothermic coagulation because I

believe in such cases this process gives less likelihood of a recurrence or metastasis than surgical excision. (4) That the patient is free from any evidence of malignant disease September 2, 1914, and I believe he will remain well.

CASE 17. Mr. G. K., age 68, referred by Drs. Robert Abbe and Frederick C. Holden, June 9, 1914. In January, 1914, a "polypus" was removed from the right nostril, which was found to be malignant. He was then treated with radium 24 days, then referred to Dr. Abbe, who did an extensive operation, removing the right alveolar border, and eviscerating the antrum and right wall of the nostril. This was followed by radium treatment. An extension of the growth developed within a month, involving one and a half inches of the incisor and left cuspid region. This disease I destroyed by electrothermic coagulation, June 11, 1914, and I preceded and followed the destruction of the disease with massive doses of deep röntgen therapy. In the first series he received 840 X, without producing any burn. This massive dose treatment was given on one day. No burn and no malignant disease evident June 29, 1914. Some malignant disease on posterior wall of antrum September 3, 1914.

The points of interest here are — (1) A small operation followed by an extensive operation. (2) Radium application for a month had no apparent effect. (3) Extensive operation followed by massive dose of radium, and again a recurrence. (4) Electrothermic coagulation of the active disease, and such massive doses of deep röntgen therapy as would hardly be justified in a less desperate case.

CASE 18. Mrs. M. L., age 54, referred by Dr. J. D. Zulick, June 24, 1914, with a new-growth of the gums between the right lateral incisor and the cuspid tooth of the lower jaw. This growth had been developing for a year, and had caused some separation of the teeth, with suspicion of disease in the upper portion of the alveolar process, as shown by röntgenograms. The three adjacent teeth were removed.

The whole area was destroyed by electrothermic coagulation, and then a portion of the alveolar process removed with bone forceps. Later this destroyed alveolar process was thrown off similar to Case 10.

CASE 19. Mr. I. S., age 60, referred by Dr. Santee, June 15, 1914, with an ulcerating, deeply indurating carcinoma extending two inches downward from the left inner canthus. It was one inch wide and one-half inch thick. It had been growing three years, and had been unsuccessfully treated by a cancer paste, applied by a charlatan. There was an adherent submaxillary gland, one inch in diameter, not sharply outlined, under the left side of the jaw. Dr. Stillwell Burns, at my request, removed this gland, and curetted the malignant ulcer, but he could not remove all of the disease about the inner canthus, and under the lower lid, without serious deformity. Therefore, I added thermic coagulation, and followed with active deep röntgen therapy, applied locally, and over the glands of the neck.

This case is of interest because of (1) the three years' duration; (2) the harmful treatment by cancer paste; (3) the metastasis and extension incompletely removed by surgery; (4) further destruction and treatment with deep röntgen therapy.

CASE 20. Mr. M., age 41, referred October 7, 1912, by Dr. George W. Pfromm and Dr. M. P. Warmuth, with an epithelioma involving the right side of the soft palate, the alveolar process about the molar teeth, and the cheek. The whole area was completely destroyed, followed by röntgen therapy. On December 6, 1912, the molar teeth were removed and the disease about the alveolar process again destroyed. To-day, September 22, 1914, he is still perfectly well. Dr. Warmuth considered this case entirely inoperable.

CONCLUSIONS

1. Electrothermic coagulation permits the destruction of a number of inoperable carcinomata and epitheliomata.

2. It is a bloodless operation, and gives decided advantages in malignant disease about the mouth.

3. I believe that metastasis is less likely to follow, because the operative area is at once completely sealed.

4. The disease must be destroyed completely.

5. Deep röntgen therapy must be applied with the best technique and with the same degree of thoroughness as if it had not been previously destroyed.

6. Good results have been obtained in a number of otherwise hopeless cases.

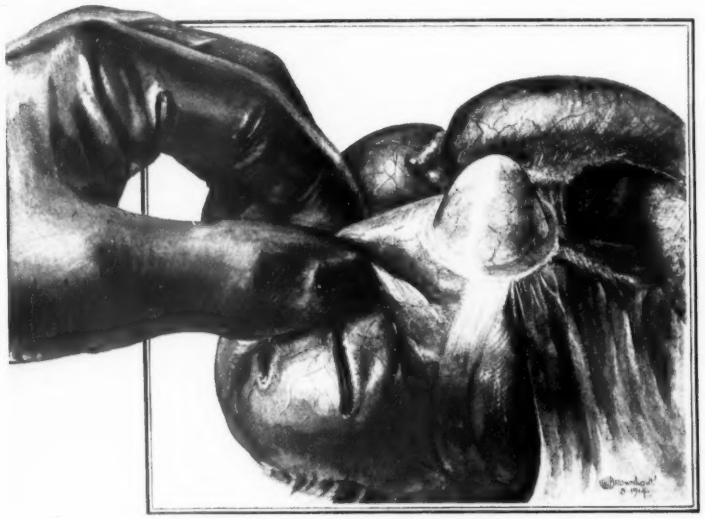
7. The time is still too short to express any valuable opinion as to its permanency.

TRAUMATIC DIVERTICULUM OF CÆCUM FOLLOWING APPENDECTOMY

By FRANK E. BUNTS, M. D., Cleveland, Ohio

So far as I am aware, attention has not yet been called to this interesting condition sometimes following appendectomy, but I feel sure that it is only necessary to mention it in order to have its presence corroborated many times.

The first case in which I noticed it was a nurse who had been operated several years previously for a non-suppurating appendicitis. Following the operation, the pain of which she previously complained, entirely disappeared for nearly a year, when she began to have renewed attacks of pain in the right side. Examinations were made on various occasions by other physicians as well as myself and it seemed that the pain must be due to a slightly enlarged ovary on the right side. Her suffering was so great that she begged for an operation at each attack, but the local conditions hardly seemed to me to justify an operation for the removal of the right ovary. However, after witnessing her suffering in three of these attacks, I opened the abdomen through the right rectus muscle and found the right ovary slightly enlarged and cystic. As a matter of curiosity I examined the site of the previous appendiceal operation and found a distinct white ring where the purse-string suture had been placed, but spread out to nearly three-fourths inch in diameter. From this ring there protruded a pouch like the finger of a glove, though somewhat conical and nearly one inch in length. By squeezing the cæcum I could force this to balloon up with gas. Its wall was quite thin, apparently devoid of any mucosa, and could be invaginated easily back into the cæcum. Feeling that the distention of this diverticulum might be the cause of some of her colicky pain and that its extreme thinness might make it a positive source of danger from rupture, it was pushed back into the cæcum and a double row of purse-string sutures applied to close the opening.



Traumatic diverticulum of cæcum following appendectomy.

Subsequent to the operation the pain had disappeared, but it is evidently impossible to say whether this diverticulum was in any way to blame for the pain; yet it seems rational to believe that it was to some extent, at least.

Since this time I have examined the cæcum in all pelvic operations in which the appendix had

previously been removed and have found two more distinct cases, though not nearly so large as the first, but the widened ring and thin dilatable wall were plainly to be seen, and in all I followed the procedure used in the first case. How much this diverticulum—or hernia,as I was first inclined to call it—of the cæcum had to do with the patient's symptoms I could not say in any of the three cases, as all had pain in the right side and all had ovaries that might readily be considered sufficiently abnormal to have caused the disturbance.

It is possible, however, that future observations may establish this condition as a definite cause of recurring pain in the right side following appendectomies.

ANASTOMOSIS OF VAS DEFERENS TO EPIDIDYMIS OF OPPOSITE SIDE FOR STERILITY[1]

By FRANCIS R. HAGNER, M. D., Washington, D. C.
Professor of Genito-Urinary Surgery, George Washington University; Attending Genito-Urinary Surgeon, Garfield Memorial Hospital and George Washington University Hospital

THE following case of sterility following double epididymitis presented a phase that allowed us to do an operation which, so far as I know, has not been performed heretofore.

J. V., male, white, age 40, presented himself with a diagnosis of sterility following gonorrhœal epididymitis. Twenty years ago he contracted his gonorrhœa, which was complicated by double epididymitis. He has been married 15 years and his wife has never been pregnant. Repeated examinations have shown no spermatozoa. He was operated on first in the fall of 1910, and a bilateral anastomosis between the vas deferens and the globus major was done. At this time no spermatozoa could be obtained from the left globus major and even incision through the tunica albuginea showed no spermatozoa, this testicle being softened and atrophied. The vas deferens was patulous, as indicated by a small probe. The right side was then operated on and a normal appearing testicle was found except for a thickening of the globus minor. When an incision was made into the globus major for anastomosis, a few spermatozoa were obtained. These were non-motile and in this feature differed from those found in our successful cases. On examining the vas deferens on this side the finest tear-duct probe could not be passed through its lumen, although I went as high up as practicable in the groin to get patulency.

The result of this operation was a failure and I suggested to the patient the possibility of bringing the good vas on the left to the better organ, that being the right testicle. At the operation the vas deferens of the left side was cut through and the distal end ligated; an opening was then made in the septum to allow the vas to pass through to the right side. Before the anastomosis was completed a small amount of argyrol was injected into the vas to be sure of its patulency. The appearance of the argyrol in the urine on the first urination following the operation proved its patulency. The anastomosis was then made, although the condition present in the globus major of the right side at the first operation, namely, only a few non-motile spermatozoa, was present also at the second operation. The patient made an uninterrupted recovery. (Fig. 1.)

From our experience this was certainly an unfavorable case because of the fewness of the spermatozoa and their lack of motility. The operation, so far as benefiting the patient was concerned, was a failure: he was as sterile as ever, as was proved by repeated examinations of the fluid collected in a condom.

Although this particular case was unsuccessful, there is no logical reason why other individuals presenting the same features except for the presence of motile spermatozoa should not be successful.

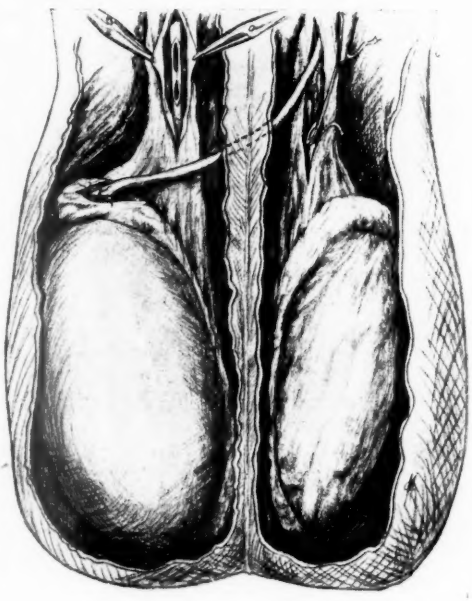


Fig. 1.

[1] Read before the American Association of Genito-Urinary Surgeons, 1913.

AN AID TO THE LITTLE-DÖDERLEIN METHOD FOR OBTAINING LOCHIAL CULTURE

By WILLIAM FAWCETT SHAW, M. D., New York

THERE is no obstetrician who has escaped the responsibility and care of puerperal sepsis in one or more of its forms. It is the concensus of current opinion that the cause of infection should be sought for in a culture obtained from the interior of the uterus.

Anyone who has studied this question has been struck with the fact that no matter how much care is taken there is still a possibility that contamination has ensued.

H. M. Little's modification of Döderlein's method for obtaining such a culture is usually employed. This consists in the use of a glass tube 35 cm. in length and 3 or 4 mm. in diameter, through which is threaded a piece of strong silk, to one end of which a rubber band is attached. After sterilization, this lochial tube is introduced under aseptic technique into the uterus, and on making traction upon the thread a certain amount of infected lochia is drawn up into the tube by suction.

We believe we have added to the excellence of this method, by the employment of an old-fashioned uterine packer as a container for the lochial tube. By so doing we insure against contamination in the introduction of the tube, and at the same time avoid the use of a volsellum forceps, the bite of which upon a soft, spongy, and often lacerated cervix is detrimental to the best interests of our patient.

A considerable experience has justified our belief that we have been uniformly successful in obtaining uncontaminated cultures.

The rough sketches herein shown illustrate our modification, which we have reason to think results in a more satisfactory bacteriological report.

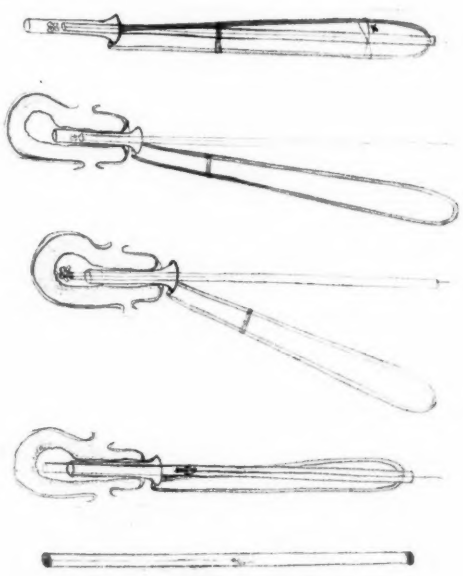


Fig. 1. Uterine packer ready for sterilization. End of glass tube and rubber bow protected from contamination by its cervical speculum. Rubber band at X holds glass tube and handle.

Fig. 2. Cervical speculum in place; end of tube and rubber bow still protected.

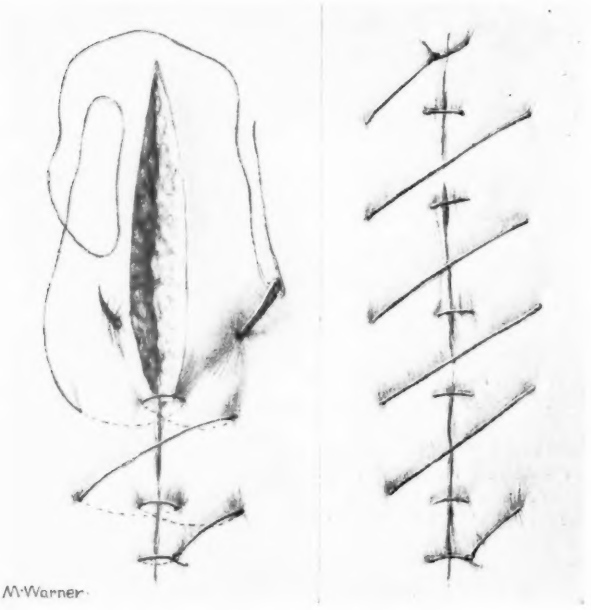
Fig. 3. Glass tube passed through speculum into fundus where rubber bow comes in contact with infected lochia.

Fig. 4. Rubber bow containing lochia drawn back into sterile glass tube about its middle.

Fig. 5. Glass tube withdrawn, ends closed with sealing wax, and ready for laboratory.

SKIN SUTURE

By CLARENCE L. HEALD, M. D., Cedar Rapids, Iowa



THE method of suturing the skin and subcutaneous tissues as shown in the accompanying illustration has the advantage of coapting accurately the skin margins, and at the same time holding the wound securely together.

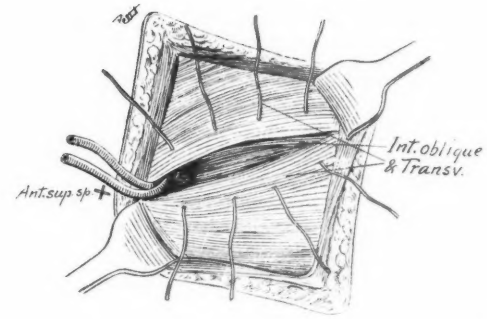
The deeper stitches distribute the tension over a larger area and the skin edges are held together without tension.

Another advantage is its extreme simplicity, and the ease and rapidity with which it can be applied.

A METHOD OF DRAINAGE IN SUPPURATIVE APPENDICITIS

By J. A. PETTIT, M. D., Portland, Oregon

IT has been found by many that drainage cases of appendicitis can be handled through a McBurney incision as well as through a more mutilating cut. For a long time the practice of draining these cases close to the ilium so that the lateral wall of the abdomen forms one wall of the sinus has been followed out by us. Ample and unobstructed drainage can be made as well in this way as in any other. In Fig. 1 will be seen the drainage tubes resting close to the ilium at the bottom of the split in the internal oblique and transversalis muscles. In suturing these muscles, this split at the base can be left open as far as the judgment of the operator dictates. Figure 2 shows an additional split made in the external oblique close to the ilium through which the tubes are drawn; and Fig. 3 shows the tubes emerging in a short cut through the skin close to the anterior



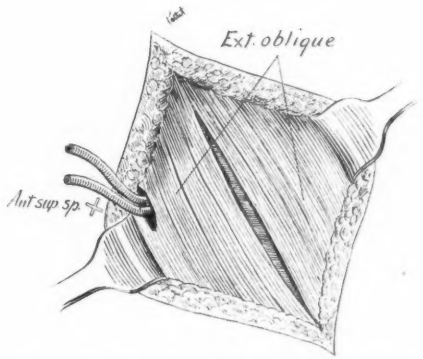


Fig. 1. (at top). Drawing showing tubes close to ilium.
Fig. 2.(at bottom). Drawing showing additional split in external oblique close to ilium.

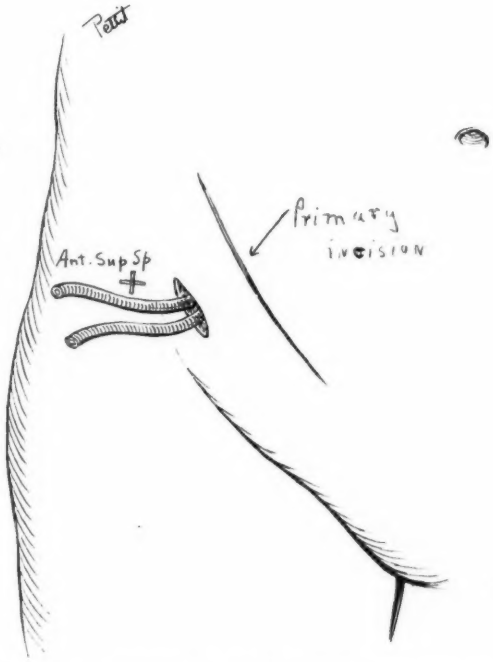


Fig. 3. Drawing showing tubes emerging in a short cut through skin.

superior spine. By this method of procedure, in addition to the advantage of having one wall of the sinus made up by the lateral bony wall of the abdomen, there is the added advantage that the pus-bearing sinus is removed from the original incision in the external oblique, fatty layer, and skin. In the event that this wound is closed by reinforcement silkworm-gut sutures tied over a pad of strongly antiseptic gauze in addition to an accurate layer suture, the original wound will be given the most favorable chance for primary union. Fatty layer infection will frequently drain beneath the skin through the drainage opening close to the anterior superior spine and thereby interfere to a minimum degree with the healing of the primary incision.

A CONTRIBUTION TO THE DISCUSSION ON INTERNAL DERANGEMENTS OF THE KNEE-JOINT[1]

By A. H. TUBBY, M. S. (Lond.), F. R. C. S., London, England

IT is a matter of sincere conviction to me that the great factor in the production of displacements of the semilunar cartilages of the knee is undue lateral movement of the joint, however produced. I would cite causes other than athletic violence. Such are a marked degree of genu valgum in adults and right-angled contraction of the tendo Achillis. The position of the legs in relation to the thighs in the former condition throws an undue strain upon the internal lateral ligament and therefore upon the internal cartilage; but the latter, that is, right-angled contraction of the tendo Achillis as a causative factor is more difficult to understand. However, it depends essentially upon this fact: that, given a short gastrocnemius, soleus, and tendo Achillis, the two joints—the knee and the ankle—over which these muscles pass must be temporarily in walking in a state of unstable and hesitating equilibrium at some portion of the stride. The usual result is a suddenly everted foot, and a sprained ankle. Occasionally, the ankle escapes and the stress falls upon the knee-joint, so that the upper end of the tibia is jerked inwards with displacement of the internal cartilage. So firmly convinced am I of the essential share taken by excessive lateral movement in the production of displacement of the semilunar cartilages that I believe, if the undue mobility can be effectually controlled, the necessity for operation is largely discounted. And in support of this statement I may detail my practice in these cases. In an early case I reduce the displaced cartilage under an anæsthetic, accepting as evidence of reduction complete extension of the knee. The limb is then placed in extension in plaster of Paris for three to six weeks to allow the injured parts to settle down and heal. Then an apparatus is fitted which permits limited flexion, but no lateral movement of the joint at all. From time to time the angle of flexion is increased, as the lateral mobility of the knee-joint becomes less marked, until full flexion and extension without pain or difficulty are present and the apparatus is discarded in six to nine months. Like Mr. Jones, I insist upon the early treatment being thorough. One can often gauge the duration of the complete rest required by noting the amount of effusion shortly after the injury. It is easy to understand why there should be effusion, when we remember that both surfaces of the semilunar cartilages are covered by synovial membrane. If the cartilages are only loosened the amount of fluid forming in the joint is comparatively small, but it is much greater when the semilunar discs are torn or doubled over.

There is one point which is often overlooked in the mechanical treatment of these cases. In the cases of weighty patients, in those with genu valgum or with much lateral movement of the knees, and in long-legged people it is necessary that the apparatus should extend nearly the whole length of the limb; in fact, from the junction of the upper and middle thirds of the thigh to the ground. A short apparatus fails to control the leverage of the limb at the knee, and therefore the joint must be controlled in the way mentioned.

Acting on these lines, I have found it necessary to operate in only five per cent of cases in my private clinic. It would be interesting to hear from Mr. Jones what proportion the cases he has found to require operation bear to those he has succeeded in curing by other methods.

There are many points about these cases still unexplained, such as why pain is felt sometimes over the outer side of the knee when the internal cartilage is damaged; also why in the majority of all knee lesions pain is so persistently located below and to the inner side of the patella. I am clear, however, that so long as tenderness remains in either of these situations the patient should be advised not to walk; and, further, in painful cases where operation is required I have often found it a satisfactory procedure to remove the subsynovial tissue on the lower and inner side of the patella.

When I decide to operate, I do so on these grounds:

1. Where the patient is unable to give the necessary time, and has not the means to afford the apparatus required for mechanical treatment.
2. Where the patient is unable to obtain his livelihood shackled by a splint.
3. In the cases of those who go up ladders, work on scaffolds or amongst machinery where a sudden and unexpected fall may be fatal.
4. Where a support has been faithfully tried and has failed.

[1] Presented in the discussion of Mr. Robert Jones's paper, "Internal Derangements of the Knee-Joint." See Surgery, Gynecology and Obstetrics, October, 1914, p. 427.

In every case of operation, its risks and results should be explained to the patient.

I decide not to operate—

1. In any case of primary displacement.

2. Where a patient is content to wear an apparatus for a considerable length of time.

In operating on a knee-joint there is, in my opinion, more risk of disaster than in almost any form of surgical procedure, and, when disaster does occur, it is overwhelming. The fact that over one thousand operations have been performed by so careful a surgeon as Mr. Robert Jones should not cause any one to relax his vigilance or to approach the matter except with the utmost care. I venture to say that the potentialities for mischief of one knee-joint are about equal to that of ten abdominal cavities.

A few points in technique may be mentioned. Very soon in my work I learned not to introduce any foreign material of any description into the joint. In one of the early cases the internal cartilage was sewn to the tibia with silk. The knee swelled, the temperature rose to 102° on the second day, and I was obliged to let out some fluid. The patient recovered perfectly well, but the forty-eight hours of anxiety I underwent are not forgotten; and I have long appreciated the value of gentle manipulations within the knee-joint. It seems to me that the chief cause of infection may be, and probably is, not the instruments or the surgeon himself but the patient's skin. In knee-joint cases I am not yet satisfied merely with the acetone and iodine method of sterilizing the skin, because the latter is often rough and thickened and I doubt if there is sufficient penetration. My practice is to have the whole limb washed with soap and water, then with ether and alcohol, and wrapped in a compress of 1 in 3,000 biniodide of mercury. This is done on two separate occasions, 48 hours before the operation, and then three hours before the operation the limb is carefully dried with sterilized swabs, acetone and iodine are applied, and the limb is wrapped in dry sterile gauze. Under no circumstances do I introduce a finger into the joint, and the capsule is sewn with a blanket suture. In closing the skin, interrupted sutures of silkworm gut are used; the gut is threaded at either end through a needle, and care is taken to pass each needle through the skin on either side of the wound from within outward. If we select a proper time for operation, i. e., not immediately after the injury, and if there is no fluid in the joint; if we take every care in sterilizing the skin, and especially in thoroughly softening and cleansing the thickened parts over the patella; and if we redouble our aseptic precautions, I am confident that we can operate on the knee-joint without undue anxiety, and our results will almost always be satisfactory.

FERMENT DIAGNOSIS (ABDERHALDEN) FOR CANCER[1]

By CHARLES GOODMAN, M. D., F. A. C. S., and SAMUEL BERKOWITZ, M. D., New York

SEVERAL thousand tests by dialysis after the method described by Emil Abderhalden and his co-workers have now found their way into the literature. While conclusive evidence of the merits of the test are substantiated by some authors, there are others who up to the present time have not been convinced of the reliability of the test in their hands and therefore question its practicability for clinical purposes. A critical review of the reports of some of these writers makes it apparent that all the details of the technique described and laid down by Abderhalden have not been mastered and complied with. The technique is intricate, and the outcome of the test depends upon the scrupulous observance of each and every detail, however minute.

Some of the earliest workers have improved their results by acquiring a corrected technique from Abderhalden or from one of his pupils, and until the details of the test have become simplified the most reliable statistics of the dialysis test will necessarily be derived from those who have received such instruction.

That the action in this test is due to blood-ferments was shown in 1909 by Abderhalden, working with Pincussohn and Weichert.[2] Abderhalden was guided by his belief that the presence of a foreign substance in the circulation is conducive to the production of antagonistic or protective bodies. That this holds true not only in pregnancy but also in other conditions has been shown by many observers, and we find that

[2] Hoppe, Seyler's Ztschr., 1909, No. 61.

[1] From the Physiological Chemical Laboratory, Beth Israel Hospital, and the Department of Physiological Surgery of the New York University.

ABDERHALDEN REACTION IN CANCER

Case Number	ccm. Serum Each Test	Time of Dialysis (hours)	Serum—Control	Serum + Carcinoma	Serum + Sarcoma	Serum + Placenta	Serum + Stomach	Serum + Artery	Serum + Pancreas	Serum + Adrenal	Clinical Diagnosis	Remarks
D.10	1.5	18	o	+	o	—	—	—	—	—	Recurrent carcinoma breast	
M.11	1.5	18	o	+	o	—	—	—	—	—	Carcinoma intestines	Post-mortem.
M.12	1.0	20	o	+	o	—	—	—	—	—	Carcinoma breast	Operated.
M.13	1.0	18	o	o	+++	—	—	—	—	—	Retroperitoneal sarcoma	Post-mortem.
B. 14	1.5	18	o	+	o	o	—	—	—	—	General carcinomatosis	Marked cachexia.
B. 15	1.5	20	o	+++	o	—	—	—	—	—	Tumor, abdomen	Carcinoma, stomach, op.
B. 16	1.0	16	o	o	+	—	—	—	—	—	Sarcoma testes	Hydrocele fluid.
B. 17	1.5	20	o	++	o	—	o	—	—	—	Carcinoma liver	Refused exploration.
M.18	1.0	24	o	o	++	—	—	—	—	—	Sarcoma femur	Section typical.
M.19	1.5	24	o	o	o	+	—	—	—	—	Carcinoma uterus?	+ Wassermann.
M.20	1.0	24	o	+	o	o	—	—	—	—	Carcinoma breast	Operated.
M.31	1.5	24	o	o	++	—	—	—	—	—	Retroperitoneal sarcoma	Ascitic fluid; post-mortem.
M.32	1.5	16	o	o	+	—	—	o	—	—	Retroperitoneal sarcoma	Blood serum.
P. 1	1.0	24	o	+	o	—	—	—	—	—	Post-op., carcinoma breast	4 years; no recurrence.
P. 2	1.5	20	o	+	o	—	—	—	—	—	Recurrent carcinoma breast	
B. 41	1.0	18	o	+	o	—	—	—	—	—	Carcinoma stomach & liver	Operated.
P. 3	1.0	20	o	++	o	—	—	—	o	—	Carcinoma stomach	Operated.
B. 42	1.0	24	o	+	o	—	—	—	—	—	Carcinoma stomach	Refused operation.
M.33	1.5	20	o	+	o	o	—	—	—	+	Carcinoma recti	Post-mortem.
M.34	1.0	24	o	+	o	—	—	—	—	—	Carcinoma liver	Post-mortem.
P. 4	1.5	20	o	+	o	—	—	—	—	—	Carcinoma stomach	Operated.
B. 43	1.5	16	o	+	o	—	—	—	—	—	Carcinoma breast	Operated.
B. 44	1.0	24	o	+	o	—	—	—	—	—	Carcinoma liver	Refused operation.
B. 45	1.5	24	o	+	o	—	—	—	—	—	Carcinoma recti	Refused operation.
B. 50	1.0	24	o	o	o	—	—	—	—	—	Carcinoma breast	Operated.
M.35	1.0	24	o	+	o	—	—	—	—	—	Carcinoma liver	Ascitic fluid; post-mortem.
B. 51	1.5	24	o	+	o	—	+	—	—	—	Carcinoma stomach	Refused operation.
B. 52	1.5	24	o	++	o	—	—	o	—	—	Carcinoma stomach	Operation.
B. 53	1.5	24	o	++	o	—	+	—	—	—	Carcinoma stomach	Operation.
B. 54	1.5	24	o	++	o	—	—	o	—	—	Carcinoma stomach	Operation.
B. 55	1.5	24	o	+	o	—	—	—	—	—	Carcinoma stomach	Operation.
B. 57	1.0	24	o	++	o	—	—	—	—	—	Carcinoma pancreas	Marked jaundice; refused operation.
P. 5	1.0	18	o	+	o	o	—	—	—	—	Carcinoma recti	Operation.

syphilis, brain abscess, mania, Basedow's disease, and cancer are among the diseases which are readily diagnosed by this method.

Recently we reported that we had found in the blood following the transplantation of the thyroid gland a ferment which was capable of digesting suprarenal.

In a series of cases of malignancy we were able to obtain 30 reactions out of 33 cases in which the results corresponded to operative, post-mortem and clinical findings. In the accompanying table one case of carcinoma was not diagnosed and one negative case was diagnosed as a sarcoma.

The imperative precautions asserted themselves with each step in this difficult procedure. Among those which should receive special mention are:

1. *Absolute asepsis* must be carried out in all the details of the test. *Especial cleanliness* must be observed in caring for the glassware.

2. The *substrate* (antigen) must be tested before each series of reactions, to avoid error from this source. Failure to macerate properly or divide the tissue in the preparation of the substrate seems to be a frequent source of error. For the purpose of maceration an ordinary meat chopper serves very well, since connective tissue usually becomes stringy and can easily be removed. The tissue should be divided into minute pieces, and not into pieces the size of a silver quarter or a bean as noted by other writers, for the point has been emphasized by Abderhalden that unless the tissue has been minutely divided before boiling it cannot be entirely freed from blood.

3. The *serum* must always be centrifuged until no red blood-corpuscles are visible after centrifuging for five minutes. Discolored serum is always discarded as valueless, as it usually gives positive results in negative cases.

4. Great care should be used in handling that part of the *thimble* which will take part in the dialysis. The thimbles used in our tests had been certified at Halle and were repeatedly tested.

The ninhydrin test is so delicate that only scrupulous care in handling the thimbles will avoid reaction due to prespiration or bacterial contamination. *Blowing* the water from the wash bottle, even with great precaution, may contaminate it with small amounts of saliva sufficient to produce conflicting results.

In conclusion one is competent to perform the tests only when such skill is acquired that negative cases are diagnosed as negative.

A METHOD OF DISTENDING THE VEINS OF THE FOREARM PREPARATORY TO INTRAVENOUS INFUSION OR SALVARSAN ADMINISTRATION

By A. F. HOGE, M. D., Fort Smith, Arkansas

THE method consists in using an inflatable rubber bag about four inches in width and long enough to encircle the arm (the arm-band from a blood-pressure apparatus answers admirably), with a tube attached leading to a hand pump with a screw escape valve. The arm-band is placed in position around the arm, well above the site of insertion of needle or cannula, and after the arm has been prepared, the whole may be covered with sterile towels.

When the operator and solutions are ready, the nurse is instructed to inflate the bag with the hand pump. The inflated bag pressing on the arm causes a stasis of the venous circulation without perceptibly obstructing the arterial flow, and any desired degree of distention of the obstructed veins may be produced. When the needle has been inserted (closed method) or the vein has been freed and the cannula inserted (open method), the nurse is instructed to turn the screw escape valve, releasing pressure and permitting reëstablishment of the venous flow. The solution may then be permitted to flow in as rapidly as is desirable.

The advantages claimed for the method are:

That the degree of distention is easily controlled. This is not possible with an ordinary tourniquet, which is often tied too tightly, thus stopping both arterial and venous flow, or tied not tightly enough, causing insufficient distention.

That there is no fumbling with knots. The entire procedure is controlled easily and well away from the site of operation.

That there is no jarring of the arm in releasing the obstruction. After the needle has entered the vein, the arm is not jarred in releasing the obstruction and the risk of displacing the needle is thus prevented.

That there is minimal danger of injuring the intima of the obstructed vessels.

This method might also be used to advantage in securing hæmostasis in, operations on the fingers, the forearm, *et cetera*.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

By MAJOR G. SEELIG, M. D., St. Louis

THERE can be no question regarding either the why or wherefore in the case of The Practice of Surgery written by Howard.[1] The author furnishes us with all necessary information on this score, plants his standard, as it were, in the very first sentence of his preface, which reads: "This textbook has been written at the request of many past and present students of the London Hospital. The main objects of the book are to give the student an introduction to surgery and to prepare him for his final examinations in that part of the medical curriculum."

The book is large and on the whole satisfactorily full. It has a flavor so obtrusively its own that it cannot escape even a casual reader; the thoughtful reader will of course note at once that this is due to the author's deliberately planned and carefully executed didactic onslaught. He literally bombards his students with tabulated data, and cudgels them with the deadly parallels of differential diagnosis, 'til one almost grows to fear that on the next page he will be furnished with a pithy mnemonic on which to hang some complicated bit of information. One cannot help feeling that the student of London Hospital who knows Howard's book will not fail to pass his final examination in surgery. Not a word of this is said by way of disparagement of the book. It is really an excellent teaching volume, written in the inimitably interesting style of the English clinician, well balanced, well classified, judicial and rational in tone, with practically no significant omissions, and without even the suspicion of unwarranted dogmatism.

The make up of the volume is so like that of Ashhurst's work, reviewed in this department a few months ago, that we need not specify the exact manner in which the chapter heads have been divided. That it is a better book for its purpose than is Ashhurst's, is due to the palpably more intensive effort on Howard's part to clarify every subject that he handles. One may fairly judge from reading the book that the reason the students of London Hospital requested Mr. Howard to write it lies in the fact that he is a gifted teacher. Yet, withal, he has striven very largely, even if more successfully, along the lines laid down by Ashhurst; namely, to teach his students *to know*. He and Ashhurst both are doing that very thing which has brought purely didactic teaching into so much undeserved obloquy and disrepute. They furnish the essential facts; they attempt to furnish the accessory thumb tacks necessary to fix the facts in memory, but they fail to develop strongly the only method of really vitalizing facts; namely, a clear exposition of the various premises upon which the final conclusions of fact rest. Let us furnish just one example for the sake of concreteness. Under the head of peritonitis Howard has various 1, 2, 3, types of classification of symptoms and treatment. The subject matter is meaty and well ordered, so as to be easily memorized, but there is not a word regarding extent of peritoneal surface, absorptive power, lymphatic and blood supply, stomata, protective bacteria, adhesive power, or any one of numerous other fundamental facts, from a full knowledge of which a student could be taught to reason out conclusions on a rational basis. There is only one way to rob medicine of the undesirable element of mysticism which more or less shrouds it even to-day, and that way consists in constantly hammering on the subject of rational thought. Primitive man interpreted disease as a manifestation of evil spirits, and Garrison in his excellent *History of Medicine* adroitly emphasizes this fact by pointing out that this false reasoning rested ultimately on primitive man's failure to establish any causal relationships between a natural object and its moving shadow. Failure to establish causal relationships leads to error to-day, exactly as it did in the Neolithic era, and it is therefore necessary for every teacher to tell his students why, to show them why, and to stimulate them to inquire why. Howard has not done this, but he has done what he set out in his preface to do.

BY way of contrast with the preceding volume, this book by Frauenthal[2] and Manning stands out sharply. The history of infantile paralysis has been written so often and so well that the authors wisely lay little stress on this phase of the subject. The book is not a summing up, not a restatement of the problem, not, in other words, encyclopædic

[1] The Practice of Surgery. By Russell Howard, M. S. (Lond.) F. R. C. S. Philadelphia and London. J. B. Lippincott Co., 1914.

[2] A Manual of Infantile Paralysis, with Modern Methods of Treatment, including Reports based on the Treatment of Three Thousand Cases. By Henry W. Frauenthal, A. C., M. D., and Jacolyn Van Vliet Manning, M. D. Philadelphia: F. A. Davis Co. 1914.

in any sense. It is rather a detailed study of a clinical entity, served in the form of a textbook. In the present state of flux of opinion concerning infantile paralysis, a textbook written on this subject comes with rather an acute shock of surprise. With so much developing each few months regarding the pathology of acute poliomyelitis, one cannot but admire the hardihood of the authors of this volume in setting forth the present state of our knowledge.

In the book are many interesting statements and studies; especially worthy of note is the part devoted to the discussion of the epidemic appearance of this disease. Manning, who has contributed this portion of the work, gives a careful analysis of the Wisconsin epidemic of 1908. He also reviews other epidemics and pandemics.

In the etiology or exciting cause of infantile paralysis the authors state that the theory of the disease being induced by the action of a chemical toxin ingested in the form of decomposed animal matter has never been supported by scientific investigation, and that this theory has fallen to the ground owing to the demonstration that the disease could be transmitted from one living host to another.

The portion of this volume devoted to therapy is exceedingly interesting to the orthopedic surgeon. Frauenthel emphasizes the value of physical therapy, massage, and passive motion. He dwells almost entirely upon this department in the treatment of paralysis, and does not, as is the rule in works on poliomyelitis, go into an elaborate description of operative procedures. In this he sounds an important note and one that might well be heeded by many orthopedic surgeons. The surgery of tendons, muscles and nerves has been so extensively exploited of late, in relationship to the treatment of infantile paralysis, that we are in danger of losing sight of the fact that much can be done for these patients by properly carried out physical exercise and mechanotherapy. N. A.

STERN'S[1] attempt to base a rational understanding of the theory and practice of bloodletting on an intimate acquaintance with its history is surely highly commendable. Into thirty-eight pages devoted to the history of venesection he crowds a mass of interesting information. The fate of the procedure through the past ages has been a romantic one; at one time practiced as a cure for all ills, then fallen almost altogether into evil repute, later revived, until to-day it takes its place as a well recognized therapeutic measure.

The author hurriedly reviews the bloodless and bloody methods of venesection and grows enthusiastic over venepuncture with a specially constructed needle of his own. His enthusiasm will not be shared by many. The exposure of a vein with the introduction of a small cannula is such a simple, safe, and sure procedure for removal of blood and a subsequent infusion that it will, to our mind, remain the favorite operation.

In spite of the author's prefatory assurance that he does not see in venesection a universal panacea, the critical reader will surely feel that his championship of the cause borders on fanaticism. His report of a case of chronic morphinism cured by two venesections is a brilliant example of a faulty conclusion arrived at by the *post hoc* route. The plea that runs through the clinical portion of the treatise, like a scarlet thread, that venesection should be employed early, and not solely as an *ultimum refugiens* makes a strong appeal to anyone who gives the matter any thought. Even in a short review one cannot help again calling attention to Stern's uncritical devotion to the method. L. S.

OATMAN'S work[2] on the fundus oculi is done in three volumes, the first of which consists of 293 pages of text with 234 illustrations and 4 colored plates. The second and third volumes are portfolios, the second containing 8 diagnostic cards and 35 stereograms and the third 44 stereograms. A stereoscope accompanies the work.

The author first describes the method of ophthalmoscopic examination, then the appearance of the normal fundus, and then takes up the changes that are found. In addition to the accompanying illustrations, references are made to the corresponding stereogram. The text is very good, as are also the illustrations. As to the stereograms, they serve a most useful purpose in demonstrating to students and those inexpert in the use of the ophthalmoscope, conditions which may be found in the fundus. But the reviewer found that many of them accentuated too much the concavity of the fundus. In cases where there was actually a difference in the niveau of the lesion and the fundus, such as choked disc and glaucoma, the stereograms showed this excellently. The work is a valuable addition to ophthalmic literature. C. L.

[1] THEORIE UND PRAXIS DER BLUTENTZIEHUNG. NACH DEM GEGENWAERTIGEN STANDE DER WISSENSCHAFT BEARBEITET. By HEINRICH STERN. Würzburg: Curt. Kabitzsch, 1914.

[2] DIAGNOSTICS OF THE FUNDUS OCULI. By Edward L. Oatman, M. D. Troy, N. Y.: The Southworth Co., 1913.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

KURZGEFASSTES HANDBUCH DER GESAMTEN FRAUENHEILKUNDE, GYNÄKOLOGIE UND GEBURTSHILFE FÜR DEN PRAKTISCHEN ARZT. By W. Liepmann. Volume III. Normale und pathologische Sexualphysiologie des Weibes, by Dr. Ludwig Fraenkel. Physiologie und Pathologie der Geburt, by Dr. Rud. Th. Jascke. Leipzig: F. C. W. Vogel, 1914.

MANUAL OF DISEASES OF THE EYE. For students and general practitioners. Eighth edition, revised. By Charles H. May, M. D. New York: William Wood & Company, 1914.

GUIDING PRINCIPLES IN SURGICAL PRACTICE. By Frederick-Emil Neef, B. S., M. D. New York: Surgery Publishing Company, 1914.

DISEASES OF BONES AND JOINTS. By Leonard W. Ely, M. D. New York: Surgery Publishing Company, 1914.

THE PRACTICE OF SURGERY. By James Gregory Mumford, M. D. Philadelphia and London: W. B. Saunders Company, 1914.

THE ILEO-CÆCAL VALVE. By A. H. Rutherford, M. D. New York: Paul B. Hoeber, 1914.

HANDBOOK OF OBSTETRICS FOR STUDENTS AND JUNIOR PRACTITIONERS IN INDIA. By Kedarnath Das, M. D. Calcutta, India: Butterworth & Co., Ltd.

THE OPERATIVE TREATMENT OF FRACTURES. Second edition. By Sir W. Arbuthnot Lane, Bart., M. S., F. R. C. S. London: The Medical Publishing Company, Ltd., 1914.

OPERATIVE SURGERY. The Head and Neck, the Thorax and the Abdomen. By Edward H. Taylor, M. D., B. S., F. R. C. S. I. London: J. & A. Churchill, 1914.

A REFERENCE HANDBOOK OF THE MEDICAL SCIENCES. Vol. IV, third edition. By various writers. New York: William Wood & Company, 1914.

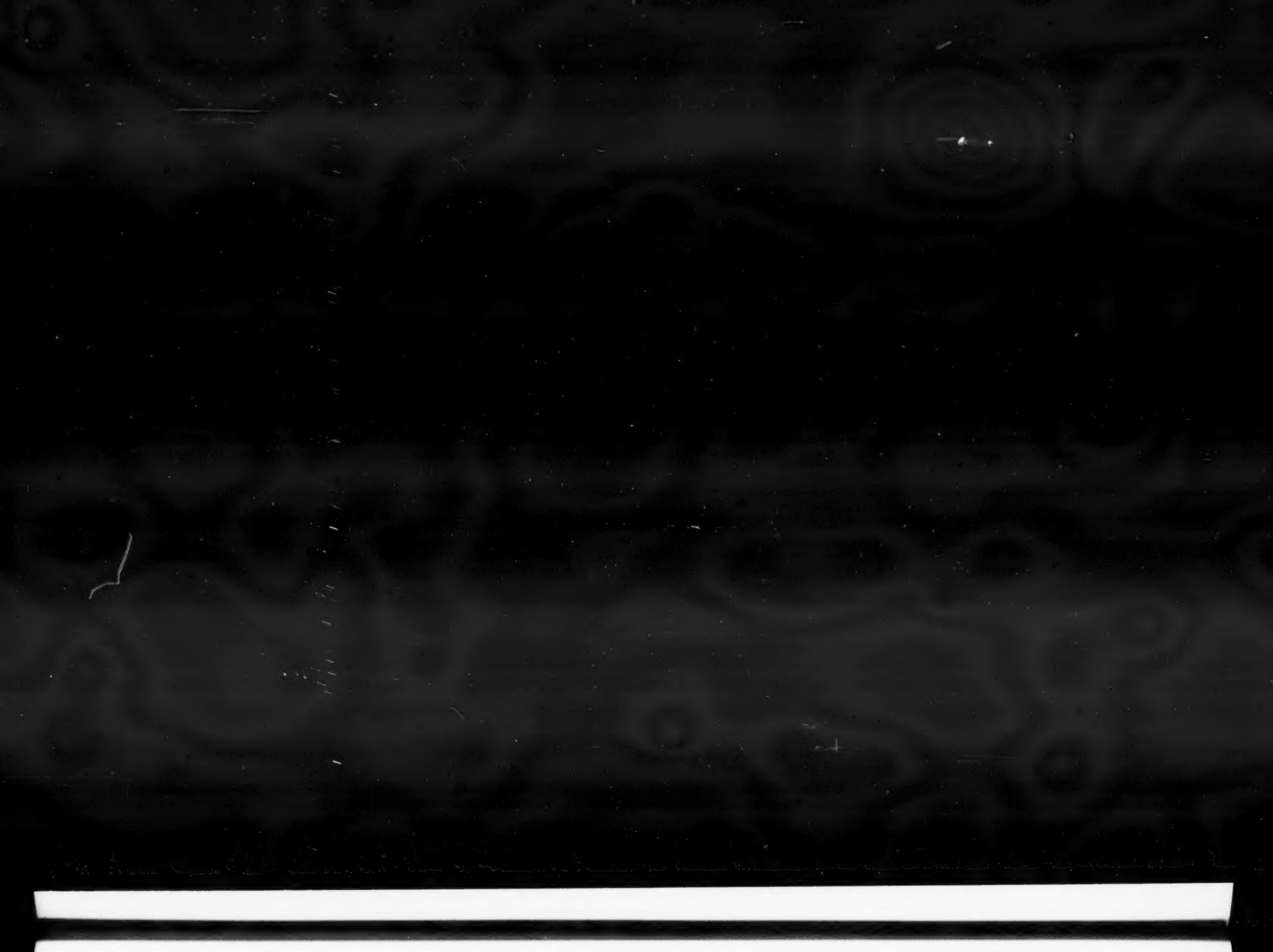
PRACTICAL BANDAGING, INCLUDING ADHESIVE AND PLASTER OF PARIS DRESSINGS. By Eldridge L. Eliason, A. B., M. D. Philadelphia and London: J. B. Lippincott Company, 1914.

THE CLINICS OF JOHN B. MURPHY, M. D., AT MERCY HOSPITAL. Volume III, No. 4. Philadelphia and London: W. B. Saunders Company, 1914.

MANUAL OF OBSTETRICS. By Edward P. Davis, A. M., M. D. Philadelphia and London: W. B. Saunders Company, 1914.

ROSE AND CARLESS'S MANUAL OF SURGERY. For students and practitioners. Ninth edition. Revised by Albert Carless, M. B., M. S. (Lond)., F. R. C. S. New York: William Wood & Company, 1914.

THERAPEUTICS OF DRY HOT AIR; with a Chapter upon the Incandescent Electric Light. Third edition, thoroughly revised. By Charles Edward Skinner, M. D., LL. D. Hammond, Indiana: Frank S. Betz Company, 1914.

THE TONSILS—FAUCIAL, LINGUAL, AND PHARYNGEAL. By Harry A. Barnes, M. D. St. Louis: C. V. Mosby Company, 1914.

MEDICAL JURISPRUDENCE; A STATEMENT OF THE LAW OF FORENSIC MEDICINE. By Elmer D. Brothers, B. S., LL. B. St. Louis: C. V. Mosby Company, 1914.